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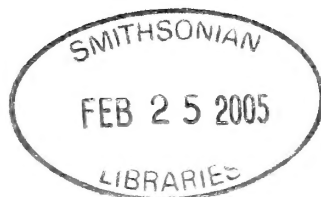
**A REVISION OF THE CARYEDONTINI (COLEOPTERA:
BRUCHIDAE: PACHYMERINAE) OF AFRICA AND
THE MIDDLE EAST**

By

CLARENCE DAN JOHNSON
BENJAMIN J. SOUTHGATE

AND

ALEX DELOBEL



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Norman E. Woodley
Editor

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TABLE OF CONTENTS

Introduction	2
Nomenclature	2
Materials and Methods	3
General	3
Authorship	4
Labels	5
Museums	5
Characters of the Caryedontini	5
Host Plant Relationships of Caryedontini	6
Distribution of the Caryedontini	13
Relationships of Species Groups of <i>Caryedon</i>	14
Cladistic Analyses	14
Systematics of Caryedontini	15
Checklist of Taxa Treated in this Paper	15
Species Groups of <i>Caryedon</i> and their Included Species	16
Subfamily Pachymerinae	16
Tribe Caryedontini	16
Key to Genera of the Tribe Caryedontini	18
Genus <i>Caryedon</i> Scheonherr	19
Key to Species Groups of <i>Caryedon</i>	20
Genus <i>Afroredon</i> Decelle	73
Key to Species of <i>Afroredon</i>	74
Genus <i>Caryotrypes</i> Decelle	77
Key to Species of <i>Caryotrypes</i>	78
Genus <i>Exoctenophorus</i> Decelle	80
Genus <i>Mimocaryedon</i> Decelle	81
Acknowledgments	82
Literature Cited	83
Figures 1–162	90
Index	120

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A Revision of the Caryedontini (Coleoptera: Bruchidae:
Pachymerinae) Of Africa and the Middle East

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ABSTRACT—The systematics of the large genus *Caryedon* Schoenherr, the smaller genera *Afroredon* Decelle (four species), *Caryotrypes* Decelle (two species), *Exoctenophorus* Decelle (one species), and *Mimocaryedon* Decelle (one species) in the tribe Caryedontini are described, keyed, and discussed. Of the 48 species of *Caryedon* treated, 13 are new (*Caryedon calderoni*, *cyprus*, *decellei*, *elongatus*, *gigas*, *maculatus*, *meinanderi*, *mesra*, *nigrinus*, *skaifei*, *sparsus*, *uganda*, and *vinsoni*). No new species were found for the other genera. The 48 species of *Caryedon* Schoenherr are divided into seven species groups. All taxa are described or redescribed and separated by means of keys or figures or both. Line drawings and photographs support the keys and descriptions. The geographical distribution and host relationships of most species of the tribe are hypothesized for the Middle East and Africa. These discussions are subjective because the published data on the distribution and host relationships are, in general, not reliable. This unreliability is due to the lack of correct names for both insects and host plants in the literature. Cross-referenced tables are provided for species of Caryedontini and their recorded host plants. Several species of *Caryedon* are considered to have wide distributions but we attribute this to probable misidentifications in the past. A major exception to this is the economic species *Caryedon serratus* (Olivier) that has a tropicopolitan distribution. The new and recently described species have limited distributions and host relationships.

INTRODUCTION

Bruchids are found in all parts of the world except around the poles and over most of the Pacific area. The majority of the species are still restricted to their areas of natural distribution, but a few have become cosmopolitan, mainly through the agency of man. The family Bruchidae consists of approximately 1700 described species and about 60 genera grouped in the subfamilies Amblycerinae, Bruchinae, Eubaptinae, Kytorhininae, Pachymerinae, and Rhaebinae (Southgate 1979, Johnson 1994). About 80% of bruchid species are in the Bruchinae, 10% in the Amblycerinae, 9% in the Pachymerinae, with the other 1% in the other three subfamilies.

In this monograph, we present the results of our research on the tribe Caryedontini (subfamily Pachymerinae) that has its origin on the Asian and African continents. At present, the tribe is composed of five genera. One of these genera, *Caryedon* Schoenherr, with over 60 species worldwide, has by far the largest number of species. The genera *Afroredon* Decelle (four species), *Caryotrypes* Decelle (two species), *Exoctenophorus* Decelle (one species), and *Mimocaryedon* Decelle (one species) compose the tribe. To our knowledge, only one species, the economic *Caryedon serratus* (Olivier), has become established outside its natural range.

The Caryedontini of Africa and the Middle East have never been studied as a whole. They have been treated piecemeal for particular countries, or more usually, an individual species has been described from a particular area. The African continent, where by far most of the species described here live, has the majority of its landmass within the tropics. Within this vast area, the climate and soil vary widely. This dictates patterns of vegetation that in turn affect the distribution of phytophagous beetles.

The development of agriculture and forestry based on modern techniques has shown the need for a more detailed study of the whole subject of the growth of plants. The forestry departments, particularly in southern Africa, have been responsible for the accumulation of a great deal of entomological material, which has emerged from seedpods collected during the course of surveys. Despite this, there are still large gaps in our knowledge of the distribution of Caryedontini in Africa, particularly from northern Kenya, Soma-

lia, Tanzania in the east, and Angola and Namibia. However, before any work on distribution and ecology of the Caryedontini can be attempted it is essential that a stable taxonomy be produced. The purpose of this paper is to lay a foundation along these lines. Descriptions are given for all taxa treated in this monograph.

NOMENCLATURE

Schoenherr (1823) named *Caryedon* but Schoenherr (1833) suppressed *Caryedon* in favor of the grex (subgenus) *Caryoborus* Schoenherr within the main group *Bruchus*. He applied the name *Pachymerus* Thunberg (1805) to another group of species, incorrectly citing *Bruchus brasiliensis* Thunberg as the type species of the genus. Pic (1913) cited *Caryoborus* as a junior synonym of *Pachymerus* Thunberg (nec Schoenherr) and *Caryedon* reappeared as a subgenus of *Pachymerus* Thunberg. Pic (1913) gave no indication as to which species were in the subgenera.

Bridwell (1929) brought some order to the classification of these bruchids when he named the new subfamily Pachymerinae containing the three new tribes Pachymerini, Caryedini, and Caryopemini. He used *Pachymerus* Thunberg, *Caryedon* Schoenherr and *Caryopemon* Jekel, as type genera, respectively, for these new tribes. Caryedini, as defined by Bridwell, covers those Old World species that are now placed in the genus *Caryedon* and its allies.

Schoenherr (1823) included only one named species (*C. serratus*) in his *Caryedon*. He stated that he knew six species that belonged to the group but named only one. Therefore, *Bruchus serratus*, or any senior synonym thereof, is the type species of the genus *Caryedon*.

Bridwell (1929) accepted Bedel's (1901) synonymy of *B. serratus* and *B. fuscus* Goeze, restated Bedel's position and gave the name of the type species of the genus *Caryedon* as *Bruchus fuscus* Goeze (1777). Bridwell repeated this in his paper on the subfamilies of the Bruchidae (1932). He also mentioned the possible synonymy of *Caryedon gonagra* (Fabricius) and *C. serratus*.

Southgate & Pope (1957) showed *C. fuscus* to be distinct from the true *C. gonagra* and stated that it was in the genus *Caryedon*, related to *C. cassiae* (Gyllenhal). Decelle (1966) validated the synonymy of *C. gonagra* and *C. serratus*. He also cor-

rectly cited the type species of *Caryedon* as *Bruchus serratus* Olivier. Decelle (1966: 172), after examining the type of *Bruchus fuscus* Goeze (1777), considered *B. fuscus* to be a member of the New World genus *Caryobruchus* and not a synonym of *Bruchus serratus* Olivier. Bottimer (1968) quoted the findings of Decelle. Nilsson & Johnson (1993: 23) agreed with Decelle and considered *C. fuscus* to be a junior synonym of *Caryobruchus gleditsiae* (Linnaeus).

The tribe Caryedini comprised only *Caryedon* until Decelle (1965) named the new genus *Afroredon* (type species: *Afroredon africanus* Decelle). Decelle (1968) then named the new genera *Mimocaryedon* Decelle (type species: *Mimocaryedon freyi* Decelle), *Caryotrypes* Decelle (type species: *Pachymerus pandani* Blanchard), and *Exoctenophorus* Decelle (type species: *Exoctenophorus deflexicollis* Decelle).

Decelle (1966) also changed the tribal names Caryedini and Caryopemini proposed by Bridwell (1929) to Caryedontini and Caryopemontini. Nilsson & Johnson (1993: 3) gave an explanation of why these names of tribes should remain Caryedini and Caryopemini. The relevant article that pertains to these names is Article 29a of the International Code of Zoological Nomenclature (Ride 1999) that states that "In zoological nomenclature, if the name of the type-genus either is or ends in a Greek or Latin word, or ends in a Greek or Latin suffix, the stem is found by deleting the case-ending of the appropriate genitive singular". The genitive singular for the word root *-don* in *Caryedon* is "odontos" (Gr.), for tooth. If the case ending (-os) for the genitive singular is removed the word root *-odont* remains. The genitive singular for the word root *-pemon* in *Caryopemon* is "pemaē" (G.), for harm, trouble. If the case ending (-ae) for the genitive singular is removed the word root *-pem* remains. Therefore, according to Article 29a, Decelle (1966) was correct in changing the tribal name Caryedini to Caryedontini but incorrect in changing Caryopemini to Caryopemontini. Possibly Decelle confused the ending of *-pemon* with the ending *-mon*, hence the ending *-mont*.

Prevett (1965) changed the ending of the specific epithet of *Caryedon albonotatus* (Pic) to *albonotatum* and explained simply in a footnote on page 530: "The emendation accords with the provisions of Article 30 of the International Code of Zoological Nomenclature, 1961" without further discussion. He then described several new species with

a neuter ending, implying that the name *Caryedon* was neuter and all the species names derived from adjectives should therefore have a neuter ending. According to the ICZN (1999: Article 30.1.), "a genus-group name that is or ends in a Greek or Latin word takes the gender given for that word in the standard Greek or Latin dictionaries, unless the Commission rules otherwise." Therefore, because the *-don* in *Caryedon* is derived from the Greek "odontos", tooth, which is masculine, the name should be treated as masculine. Schoenherr (1823), when he described *Caryedon*, designated *Bruchus serratus* as the type of the genus. Because the ending of *serratus* is masculine, we believe this to indicate that Schoenherr considered the name *Caryedon* to be masculine, as have most subsequent authors (see especially Decelle 1966: 172) who have used the name. It will be so treated in this paper as will other species names derived from adjectives named originally with a neuter ending.

MATERIALS AND METHODS

GENERAL

Terms used to describe the male genitalia are from Kingsolver (1970), who used a modification of the terminology of Sharp & Muir (1912), and presented a table of homologous terms used by various authors for parts of the male genitalia. We also follow terminology of Nilsson & Johnson (1993) for external structures. The terminology in the descriptions of the female genitalia and external characteristics is based upon Torre-Bueno (1989).

The female and especially the male genitalia have very useful characters for classifying the Caryedontini. We advocate that care be taken when extracting and storing the genitalia so that structures used as characters may be preserved. The best technique is to relax a whole specimen in hot 70% ethanol for 3 to 12 minutes in a small beaker. The length of time is dependent upon the condition and size of the specimens. Once the specimen is relaxed so that the genitalia may be removed without damaging other structures of the specimen, its genitalia are removed by placing a beetle up-side-down under a dissecting microscope on a piece of Styrofoam® weighted with a Stender dish. The beetle is held in place with dissecting forceps, the space between the apex of the

pygidium and the last abdominal segment is opened with another pair of forceps, and the genitalia removed. Extracted genitalia are cleared of tissue by treatment in hot 10% potassium hydroxide (KOH) for 2–6 minutes. Care must be used to assure that the genitalia are not kept too long in the KOH because this makes the genitalia transparent and of no use for identification. After treatment in KOH, the genitalia are washed in alcohol or dilute acetic acid and then stored in genitalia microvials in a small drop of glycerin. The genitalia vials are then attached to the pin of the specimen from which the genitalia were removed. Permanent mounting on slides may be adequate for some studies but the inherent danger of separation of specimen and genitalia is too great in our view. It should be noted that slide preparations of male genitalia show considerable variation within a single species. This is primarily due to the age of the specimen dissected, the state of the median lobe at the death of the specimen, and also on mounting technique. A large number of specimens die or are killed with the internal sac everted or inflated (Fig. 55) that is, in the position in which it would normally be found during copulation. Here the identification must rely on the shape of individual hooks or pairs of hooks together with the spines or groups of spines that would normally lie in the retracted basal piece of the median lobe.

The same treatment is used for dissecting the genitalia of females. Extreme care must be exercised in the initial dissection of female genitalia from the abdomen as the bursa copulatrix is very lightly sclerotized and consequently extremely fragile. In some old specimens, the bursa copulatrix is sometimes completely disintegrated. The spiculum ventrale, shape of the ovipositor, the shape of the vaginal sclerites, and armature of the bursa copulatrix are preserved using this technique. Slide mounted specimens of these are extremely difficult to identify as the basal edge is very thin and difficult to see unless viewed under dark ground illumination.

We suggest that to adequately study both male and female genitalia from many angles the technique of Kingsolver (1962) be used. This technique involves the use of a white cap from a prescription drug bottle. A small drop of glycerin is placed in the cap and the genitalia placed in the drop. The genitalia may be manipulated with forceps and viewed from all angles under a dissect-

ing microscope. This allows an excellent view of all possible structures that may be used as characters. For our studies, we did not find it necessary to stain the genitalia in any way despite the recommendations by Mukerji & Chatterjee (1951).

We obtained host plant names mostly from published records. Many of the host names are older names that have been changed by botanists since they were published. To update the names we used two valuable databases that are available when current plant names are needed. These are: ILDIS (International Legume Database and Information Service (www.ildis.org)) and Missouri Botanical Garden's Vascular Tropicos database (www.mobot.mobot.org). These databases are updated continuously, and highly reliable. We placed modern names and the names as they were originally published after each species of Caryedontini. This reduced the number of host species and increased the number of subspecies. To conserve space and make this monograph more legible, the authors of host plant names are only given in Table 2.

AUTHORSHIP

Benjamin J. Southgate wrote the initial draft of this monograph in 1969 as a thesis to fulfill the requirements for an MI in Biology. Unfortunately, Ben Southgate died in March 1985 without publishing the thesis. Sharon Shute of the British Museum asked Johnson to complete his friend Southgate's thesis for publication. In about 1996, Shute provided Johnson with a copy of the original draft of the thesis and the specimens that Southgate used for his studies. Johnson then asked Alex Delobel to add his expertise to complete the study. This monograph is a result of the combined efforts of the three authors.

Southgate did the basic research of sorting, dissecting, and partially describing and redescribing most of the *Caryedon* species and three of the *Afroredon* species in this monograph. Southgate did not mention *Caryotrypes* Decelle (two species), *Exoctenophorus* Decelle (one species), and *Mimocaryedon* Decelle (one species), and all new genera in the Caryedontini published by Decelle (1968). Southgate described 18 (pared to 13 in this monograph) "new species" of *Caryedon* in his thesis but did not write diagnoses for them. Southgate contributed draft figures for the new species.

Johnson searched the literature and brought

the information on the tribe Caryedontini for the last 35 years up-to-date, adding the genera *Caryotypes*, *Exoctenophorus*, and *Mimocaryedon* and one species of *Afroredon* to the paper. Johnson wrote diagnoses for the 14 new species described here and discussed differences between the taxa in this paper, redescribed all the species in the paper, drew new, more legible figures, translated several descriptions of species from French, added and discussed many host plants not considered by Southgate, brought distributions of species in the tribe into perspective, wrote new keys to taxa and edited the manuscript.

Delobel contributed synonymies of species, drew some new, more legible figures, made measurements of specimens, literature citations, and general help with types in the MNHN and critically reviewed and added new information to the paper.

LABELS

The labels attached to all specimens are quoted verbatim and included in this monograph so that distribution data, host plants, and types can be readily identified. In some cases, the names on the labels were misspelled or were earlier names for the countries in which the insects were collected. Under Distribution, we have tried to interpret these names into present-day names of the localities and countries after the labels with the colonial names on them are listed.

MUSEUMS

Acronyms for museums used in this monograph were obtained from <http://hbs.bishopmuseum.org/codens/>. In the synonymical bibliography of each species, immediately following the type locality, we have included the acronym of the museum in which the primary type is housed. Acronyms are also used for type depositories of new species. The following acronyms were used:

BMNH	The Natural History Museum, London, U.K.
DEI	Deutsches Entomologisches Institut, Eberswalde Finow, Germany
INHM	Iraq Natural History Museum, Baghdad
MHNG	Muséum d'Histoire Naturelle, Genève, Switzerland
NMB	Naturhistorisches Museum Basel,

Basel, Switzerland (includes material from the former Museum Georg Frey)

MNHN	Muséum National d'Histoire Naturelle, Paris, France
MRAC	Musée Royal de l'Afrique Centrale, Tervuren, Belgium
MZS	Museo Zoologico La Specola dell'Università di Firenze, Italy
NRS	Naturhistoriska Riksmuseet, Stockholm, Sweden
PAN	Polish Academy of Sciences, Warsaw, Poland
SANC	South African National Collection of Insects, Biosystematics Division, ARC-Plant Protection Research Institute, Pretoria, South Africa
UZMH	Zoological Museum, Finnish Museum of Natural History Museum, Helsinki, Finland
UZMC	Zoologisk Museum, Københavns Universitet, Copenhagen, Denmark
ZMAS	Zoological Institute, Academy of Sciences, St. Petersburg, Russia
ZMB	Zoologisches Museum, Humboldt Universität, Berlin, Germany
ZMUM	Zoological Museum, Moscow State University, Moscow, Russia

Specimens for this study were borrowed from the collections noted above as well as those of C. W. and L. B. O'Brien, Tallahassee, Florida; Department of Plant Protection, Tel Aviv, Israel; and the Institut de Recherche Scientifique à Madagascar, Tananarive, Madagascar. The collection of the Institut de Recherche Scientifique à Madagascar is now deposited in the MNHN.

CHARACTERS OF THE CARYEDONTINI

Nilsson & Johnson (1993) discussed characters useful for the Pachymerini in a section on "Structures of Value as Taxonomic Characters". Their discussion is of considerable value as we used many of the same characters, but we could not use all the structures that are of value in the tribe Pachymerini. The discussion of structures used as characters by Nilsson & Johnson (1993) is a valuable guide to taxonomists studying the subfamily Pachymerinae.

We found that patterns of pubescence on external surfaces and the structure of the male and female genitalia were of greatest value in arriving

at the present classification of the species of *Caryedon* treated in this monograph. The structure of the hind femur and ventral surfaces of the body show great promise in facilitating identification and classification, but more study is needed by future students of taxonomic research on the Caryedontini.

Many structures were examined to find characters with which to classify the Caryedontini. External characters of value were body size; color of the head, antennae, pronotum, elytra, pygidium, and legs; patterns (if any) of vestiture of the head, pronotum, elytra, and abdominal sterna; presence of a medial carina on the frons; size and shape of the eyes; antennal length and shape; distance by which the prosternum separates the procoxae; shape of the scutellum; distance between elytral striae at their bases and whether they are joined at their apices. The hind femur has several structures of value as characters. When the hind is leg flexed, the tibia is positioned on the medial side of the pecten in the genus *Exoctenophorus* while in all other species in the tribe the tibia is positioned on the lateral side of the pecten. Of significant value are the structures on the ventral surface of the hind femur. From the base to about midway to the apex or slightly more is an area termed the prepectenar ridge that is followed by the pecten that extends to the apex (Fig. 1). The prepectenar ridge varies from smooth in some species, lacking serrations, to occasionally having serrations similar to those of the pecten (Fig. 2). The pecten usually has one large spine about 0.6 from its base followed by several smaller spines (Fig. 1).

Characters of the male genitalia used were length, shape and width of the ventral valve, pattern of armature and numbers and shapes of spines of the internal sac, and depth of the cleft of the lateral lobes and the shape of their apices.

Characters of the female genitalia used were the pattern of the vaginal sclerites and any armature borne by the bursa copulatrix.

For the purposes of this paper, the *Denticulatus* Group is separated from the other six species groups by the pattern of the armature on the ventral surface of the hind femur. The other six species groups of *Caryedon* are defined by the different patterns of pubescence on their external surfaces in the key to groups. Thus, the pattern of pubescence is of significant value in classifying species of *Caryedon*.

The pubescence of the Caryedontini is difficult

to describe as the color may vary with the source of light used to examine it. For instance, pubescence may be described as golden when viewed under tungsten light but this can change considerably when viewed in daylight. There are two main types of pubescence: 1) that which thickly covers the integument and appears coarse, and 2) pubescence that appears much finer in texture and only partially covers the integument allowing the basic color of the insect to be easily seen.

HOST PLANT RELATIONSHIPS OF CARYEDONTINI

All bruchid larvae feed in seeds and about 84% of bruchid species feed in the seeds of the Fabaceae. The others feed in the families Areaceae (4.5%), Convolvulaceae (4.5%), and the Malvaceae (2%). The other 5% feed in the seeds of 31 to 35 other plant families (Johnson 1970). The most complete published list of host plants of bruchids is on microfiche in Johnson (1981). For more up-to-date information on bruchid host plants, as of this writing Jesús Romero Nápoles of Mexico, Cibele S. Ribeiro Costa of Brazil, and Geoff Morse, John M. Kingsolver and C. D. Johnson of the U.S.A. maintain computer databases on bruchid host plants.

There are few published host plant records for the Bruchidae of the Old World when compared to the New World. This is largely due to the collecting efforts of L. J. Bottimer, D. H. Janzen, and C. D. Johnson. All were careful to collect and store voucher specimens of plants in herbaria and to carefully identify and store the bruchids.

Species of *Caryedon* have been reported to feed naturally in two of the subfamilies of the Fabaceae: Caesalpinoideae (*Bauhinia*, *Piliostigma*, *Cassia*, *Dialium*, *Tamarindus*, *Parkinsonia*, etc.) and Mimosoideae (*Acacia*, *Prosopis*, *Dichrostachys* etc.). The introduced groundnut (*Arachis hypogaea*) and pongam (*Pongamia pinnata*), both fed upon in storage, are the only plants known to us in the third subfamily (Papilionoideae) that is fed upon by a *Caryedon*.

Most published host records for the Caryedontini are unreliable (Southgate, unpublished). When discussing host plant and host relationships in any group of organisms it is imperative that reliable data are used. A major problem with many bruchids, especially those that are of eco-

nomic importance and often with a wide distribution, is that they have several synonyms and have been misidentified frequently. There is a similar problem with the reliability of the identity of what have been reported as host plants. The plants may be misidentified or synonyms may exist. One of several examples is *Acacia arabica*. The name *A. arabica* has been used for *A. nilotica* (L.) Delile. In Asia, the host could be *A. nilotica indica* (Benth.) Brenan, but in Africa, it would be one of the various subspecies of *A. nilotica*. Another problem is what is considered to be a host plant for bruchid beetles. We define a host plant as a plant whose seeds are fed upon by bruchid larvae. This is complicated in economic species such as *Caryedon serratus* because often eggs are laid on seeds in storage that are not "natural" hosts in nature. Thus, storage hosts may not be field hosts. Some species of bruchids broaden their host range by feeding in another plant species when a plant is introduced into a new area. For example, P. F. Prevett (pers. comm.) recorded *Caryedon cassiae* feeding in the pods of *Cassia javanica* when it was planted as an introduced ornamental tree in Sierra Leone. There was extensive damage to the seeds so that very few were viable, thus showing the potential damage that can occur if one of these species proves capable of breeding in hosts of economic importance. This phenomenon has not been observed in Senegal and bruchids feeding in the seeds of an introduced plant would be unusual (Delobel, unpublished). This example shows a special problem for evolutionary biologists when evolutionary interactions are studied and compared between various species of hosts and bruchids.

Our accumulated data from the literature (Tables 1, indicate that four species of *Caryedon* have several more hosts published for them than other species of *Caryedon*. These data show *C. acaciae* (Gyllenhal) has about 12 published hosts, *C. cassiae* about 16, *C. pallidus* (Olivier) about 14, and *C. serratus* about 58 (Table 1). We hypothesize that of the species of *Caryedon* that we have studied, only *C. serratus* feeds in seeds of *Arachis hypogaea* and *Tamarindus indica*. The reports of other species feeding in these two plants are probably misidentifications of the insects or perhaps the plants. Then, because *C. acaciae* is reported to feed in 11 species of *Acacia*, *C. acaciae* probably is specific to species in that genus. Other species of *Caryedon* that appear to be specific or almost specific to *Acacia*

are *C. albonotatus*, *C. multinotatus* (Pic), and *C. palaestinus* Southgate. The reports of *C. interstinctus* (Fåhræus) feeding in seeds of *Acacia* are unreliable. Delobel *et al.* (2000) demonstrated that *C. crampeli*, *C. pallidus*, and *C. serratus* could not survive in five species of seeds of *Acacia* in the laboratory. This is significant because it is possible in the laboratory to induce bruchids to oviposit and the insects to feed through several generations in seeds that are not their normal hosts in nature (e.g., Johnson 1981b). Therefore, based upon the evidence presented by Delobel *et al.* (2000), we hypothesize that reports of *C. crampeli*, *C. pallidus* and especially *C. serratus* feeding in the seeds of about 10 species of *Acacia* are spurious at best.

Reports of *C. cassiae* feeding in seeds of about ten species of *Cassia* and *Senna* (Table 1) tend to support that this species feeds in species of *Cassia* (s. l.) as primary hosts. The reports of *C. cassiae* feeding in seeds of the seven other hosts in Table 1 we consider to be unreliable for reasons stated above. The reports of *C. maculipes* (Pic), *C. sudanensis* Southgate, and *C. yemenensis* Decelle feeding in *Cassia* and *Senna* are probably reliable. Based upon the evidence presented by Delobel *et al.* (2000) it is probable that the nine species of *Cassia* reported to be fed upon by *C. pallidus* and the 13 species reported to be fed upon by *C. serratus* are at least valid for some of the species of *Cassia*. Probably at least some of these reports are the result of misidentification of the bruchids. Delobel *et al.* (2000) seem to have shown that *C. pallidus* feeds naturally in possibly nine species of *Cassia* but not in seeds of *Acacia*. It is certainly possible that *C. crampeli*, *C. pallidus* and *C. serratus* may be limited in their abilities to feed in different genera of hosts based upon subfamilial difference in the plants (e.g., *Acacia* is in the Mimosoideae and *Cassia* is in the Caesalpinoideae).

The most economically important species, *C. serratus*, almost certainly originated in Asia (Southgate, unpublished), and came to the east coast of Africa by way of camel trains through Arabia or by Arab dhow across the Indian Ocean in the seeds of its primary host, *Tamarindus indica*. *Tamarindus indica* is tropicopolitan as it has been introduced to various parts of the world and used as an ornamental plant and cultivated because of its various economic attributes. The fruit is eaten by people either directly, as a condiment, or as a drink. The tree has many medicinal uses. The

fruit pulp is used as a laxative, the bark is used to cure sore throats, the leaves are used for stomach problems, and the roots are used to treat heart pains. Crushed leaves are put on wounds and abscesses. Juice from crushed leaves is taken with porridge to stop vomiting. The wood is hard, heavy, and dark brown. It is difficult to work but easy to polish and is termite resistant. It is used to make furniture and as timber to make domestic items and boats. It is also a good firewood and source of charcoal. The flowers are reported to make good honey. Its ash, which is rich in tannin, is used for tanning hides.

The best and most economically important example of *C. serratus* transferring to another host in storage is its transfer to *Arachis hypogaea* (groundnuts, peanuts, maní, or cacahuates). Groundnuts are legumes with subterranean fruits. They are native to South America from where they spread throughout the New World and subsequently to the Old World as Spanish explorers discovered their versatile uses. Groundnuts are grown commonly in China and India, the Sub-Saharan African countries and North, Central and South America. India, China, and the United States produce about 70 percent of the world's groundnuts. The main use of groundnut is as a source of edible oil, but the high oil and protein contents also make it an important food crop. *Caryedon serratus* is an economic problem in the Old World where it feeds on groundnuts in storage. To our knowledge, it does not feed on groundnuts in the New World.

We believe many of the host records in the literature (Table 1) for *Caryedon serratus* are unreliable. Misidentifications of both insects and plants probably account for much of the confusion. It is not unusual to find a species of *Caryedon* feeding in seeds that is not *C. serratus* but identified as that species. In the New World, where *Tamarindus indica* and *C. serratus* have been introduced, transfer to other hosts in nature has been observed. *Caryedon serratus* is known to feed in seeds of both *Bauhinia variegata* (Nilsson & Johnson 1992) and *Cassia moschata* (Romero & Johnson 2002) in the New World. *Tamarindus indica* has been widely planted in the New World and is common in the American tropics and subtropics. *Caryedon serratus* has been reported to feed in seeds of eight species of *Prosopis* in the Old World. If these reports are reliable then one would expect that *C. serratus* would begin to feed in the forests of

Prosopis in the New World. Because *C. serratus* has transferred to a species of *Cassia* and of *Bauhinia* in the New World, we hypothesize that the reports of this species feeding in seven species of *Bauhinia* and fifteen species *Cassia* in the Old World are at least partially valid. Until we receive information to the contrary, we accept that *C. serratus* feeds in *Piliostigma* and *Pongamia pinnata*. We doubt that *C. serratus* feeds in *Acacia*, *Albizia*, *Caesalpinia*, *Dialium*, *Erythrina*, *Poinciana* and *Terminalia*. We do not accept that *C. serratus* feeds in seeds of the genera *Casuarina*, *Oryza*, and *Rhamnus* that are all in families other than the Fabaceae (Table 1). We believe that any recorded host for bruchids except for the obvious (e.g., tamarind and groundnuts for *C. serratus*) should be verified.

There are species of *Caryedon* that demonstrate host specificity to other plant families (Tables 1, 2). *Caryedon atrohumeralis* Preveit, *C. calderoni* Johnson, Southgate & Delobel, *C. conformis* (Fåhræus), *C. elongatus* Johnson, Southgate & Delobel, *C. fasciatus* Preveit, *C. fuliginosus* Preveit, *C. immaculatus* Preveit, *C. longipennis* (Pic), and *C. lunatus* Preveit show a distinct preference for seeds of species of *Combretum* in the family Combretaceae. *Caryedon fathalae* Delobel and *C. macropterae* Delobel show preference for the genus *Terminalia*, another genus in the Combretaceae. Bruchids in the genus *Amblycerus* Thunberg feed in both genera in the New World.

The species *C. germari* Küster and *C. mesra* Johnson, Southgate & Delobel are the only *Caryedon* reported to feed in the Apiaceae (the genera *Lisaea* and *Ferula*, respectively). *Caryedon cyprus* Johnson, Southgate & Delobel may also feed in *Ferula* but this has yet to be demonstrated.

Caryedon dialii Decelle is the only species of *Caryedon* that we consider to feed naturally in seeds of *Dialium*.

Of the other Caryedontini, *Caryotrypes pandani* (Blanchard) has a reported, but unverified and unlikely record of feeding in an unknown species of *Pandanus* (Pandanaeae). Larval hosts of *Exoctenophorus*, *Afroredon*, and *Mimocaryedon*, are unknown (Table 1).

There seems to be little, if any, correlation between host plants and species groups of *Caryedon*. The only moderately strong correlation is that all of the four species in the *Longipennis* Group feed in seeds of species of *Combretum* (Tables 1, 2). Of the other six species that feed in *Combretum*, four

are now placed in the *Acaciae* Group and two in the *Serratus* Group.

In summary, a major problem in trying to determine host plant records and relationships between species of *Caryedontini* and their hosts is that some species are widely distributed. For instance, the economically important *Caryedon serratus* has several synonyms and has been misidentified frequently. The definition of a host plant for bruchid beetles is another problem. We define a host plant as a plant whose seeds are fed upon by bruchid larvae. In the literature, reports are given for bruchids that are found on the

plants and not in the seeds. This is complicated in the economic species *Caryedon serratus* because often eggs are laid on seeds in storage that are not hosts in nature. Thus, storage hosts may only be storage hosts. Some species of bruchids broaden their host range by feeding in another plant species when a plant is introduced into a new area. Examples of this have been observed with species of *Caryedon*. Therefore, it is imperative that when data on host plants are collected, reliable methods be used. We are now encumbered with a literature that must be used judiciously before it is considered to be accurate.

Table 1. Host plant records for *Caryedontini*. Most plants are in the family Fabaceae. Authors' names of plants are listed in Table 2. Plants in families other than Fabaceae are followed by the family name in parentheses the first time they are listed.

Species of <i>Caryedon</i>	Hosts
<i>acaciae</i>	<i>Acacia auriculiformis</i> ; <i>A. borleae</i> ; <i>A. farnesiana</i> ; <i>A. kochii</i> ; <i>A. nilotica</i> ; <i>A. nilotica</i> subsp. <i>adstringens</i> ; <i>A. nilotica</i> subsp. <i>nilotica</i> ; <i>A. nilotica</i> subsp. <i>tomentosa</i> ; <i>A. polyacantha</i> ; <i>A. polyacantha</i> subsp. <i>campylacantha</i> ; <i>A. reficiens</i> ; <i>A. seyal</i> ; <i>A. sieberiana</i> ; <i>A. tortilis</i> ; <i>A. tortilis</i> subsp. <i>raddiana</i> ; <i>Arachis hypogaea</i> ; <i>Tamarindus indica</i>
<i>albonotatus</i>	<i>Acacia erioloba</i> ; <i>A. nilotica</i> ; <i>A. nilotica</i> subsp. <i>adstringens</i> ; <i>A. sieberiana</i> ; <i>A. tortilis</i>
<i>alluaudi</i>	Unknown
<i>amplipennis</i>	Unknown
<i>atrohumeralis</i>	<i>Combretum hypopilinum</i> (Combretaceae); <i>C. lamprocarpum</i>
<i>calderoni</i>	<i>Combretum</i> sp.
<i>cassiae</i>	<i>Acacia nilotica</i> ; <i>Arachis hypogaea</i> ; <i>Bauhinia reticulata</i> ; <i>B. rufescens</i> ; <i>Cajanus</i> sp.; <i>Cassia arereh</i> ; <i>C. javanica</i> ; <i>C. javanica</i> subsp. <i>nodosa</i> ; <i>C. sieberiana</i> ; <i>C. surattensis</i> ; <i>Cassia</i> sp.; <i>Delonix regia</i> ; <i>Prosopis africana</i> ; <i>Rhamnus purshiana</i> (?) (Rhamnaceae); <i>Senna alata</i> ; <i>S. hirsute</i> ; <i>S. obtusifolia</i> ; <i>S. occidentalis</i> ; <i>S. podocarpa</i> ; <i>Terminalia</i> sp. (?) (Combretaceae)
<i>conformis</i>	<i>Combretum lamprocarpum</i>
<i>congensis</i>	<i>Bauhinia thonningii</i>
<i>crampeli</i>	<i>Bauhinia reticulata</i> ; <i>B. rufescens</i> ; <i>B. variegata</i> ; <i>Cassia sieberiana</i> ; <i>Prosopis africana</i> ; <i>Senna alata</i>
<i>cyprus</i>	Unknown
<i>denticulatus</i>	Unknown
<i>decellei</i>	Unknown
<i>dialii</i>	<i>Dialium guineense</i> ; <i>D. pachyphyllum</i> ; <i>Prosopis africana</i>
<i>elongatus</i>	<i>Combretum suluense</i>
<i>fasciatus</i>	<i>Combretum lamprocarpum</i>
<i>fathalae</i>	<i>Terminalia macroptera</i> (Combretaceae)
<i>fuliginosus</i>	<i>Combretum ghasalense</i> ; <i>C. glutinosum</i>
<i>germari</i>	<i>Lisaea heterocarpa</i> (Apiaceae)
<i>gigas</i>	Unknown
<i>grandis</i>	Unknown
<i>immaculatus</i>	<i>Combretum micranthum</i>
<i>interstinctus</i>	<i>Acacia erioloba</i> (?); <i>A. horrida</i> (?)
<i>johni</i>	Unknown
<i>kivuensis</i>	Unknown
<i>longipennis</i>	<i>Combretum cordofanum</i> ; <i>C. ghasalense</i> ; <i>C. glutinosum</i> ; <i>C. hartmannianum</i> ; <i>C. hypopilinum</i> ; <i>C. lamprocarpum</i> ; <i>C. micranthum</i> ; <i>C. molle</i>

Table 1. (Continued)

<i>longus</i>	<i>Arachis hypogaea</i> ; <i>Faidherbia albida</i> ; <i>Prosopis africana</i> ; <i>P. chilensis</i> ; <i>Tamarindus indica</i>
<i>lunatus</i>	<i>Combretum glutinosum</i> (?); <i>C. hypopilinum</i> (?); <i>C. micranthum</i> ; <i>C. molle</i>
<i>macropterae</i>	<i>Terminalia macroptera</i>
<i>maculipes</i>	<i>Cassia</i> sp.; <i>Senna occidentalis</i>
<i>maculatus</i>	Unknown
<i>meinanderi</i>	Unknown
<i>mesra</i>	<i>Ferula communis</i> (Apiaceae)
<i>multinotatus</i>	<i>Acacia erioloba</i>
<i>nigrinus</i>	Unknown
<i>nigrosignatus</i>	Unknown
<i>palaestinus</i>	<i>Acacia gerrardii</i> ; <i>A. leucophloea</i> ; <i>A. tortilis</i> subsp. <i>raddiana</i> ; <i>A. tortilis</i> subsp. <i>tortilis</i> ; <i>Prosopis cineraria</i> ; <i>P. farcta</i>
<i>pallidus</i>	<i>Acacia ataxacantha</i> ; <i>A. seyal</i> (?); <i>A. vereck</i> ; <i>A. verugera</i> ; <i>Arachis hypogaea</i> ; <i>Cassia</i> sp. <i>C. italica</i> ; <i>C. italica</i> subsp. <i>italica</i> ; <i>C. mimosoides</i> ; <i>C. sieberiana</i> ; <i>C. tora</i> ; <i>Faidherbia albida</i> ; <i>Senna alexandrina</i> ; <i>S. obtusifolia</i> ; <i>S. occidentalis</i> ; <i>S. singueana</i>
<i>proszynskii</i>	Unknown
<i>serratus</i>	<i>Acacia chundra</i> ; <i>A. confusa</i> ; <i>A. farnesiana</i> ; <i>A. gerrardii</i> ; <i>A. leucophloea</i> ; <i>A. nilotica</i> ; <i>A. nilotica</i> subsp. <i>tomentosa</i> ; <i>A. pennata</i> ; <i>A. senegal</i> ; <i>A. tortilis</i> ; <i>A. tortilis</i> subsp. <i>raddiana</i> ; <i>A. tortilis</i> subsp. <i>spirocarpa</i> ; <i>A. tortilis</i> subsp. <i>tortilis</i> ; <i>Albizia lebbeck</i> ; <i>Arachis hypogaea</i> ; <i>Bauhinia acuminata</i> ; <i>B. galpinii</i> ; <i>B. monandra</i> ; <i>B. racemosa</i> ; <i>B. reticulata</i> ; <i>B. rufescens</i> ; <i>B. thonningii</i> ; <i>B. tomentosa</i> ; <i>B. variegata</i> ; <i>Caesalpinia pulcherrima</i> ; <i>Cassia arereh</i> ; <i>C. brewsterii</i> ; <i>C. fistula</i> ; <i>C. foetida</i> ; <i>C. grandis</i> ; <i>C. javanica</i> ; <i>C. javanica</i> subsp. <i>nodosa</i> ; <i>C. montana</i> ; <i>C. moschata</i> ; <i>C. muritura</i> ; <i>C. sieberiana</i> ; <i>Casuarina equisetifolia</i> (?) (Casuarinaceae); <i>Dialium guineense</i> ; <i>Erythrina monosperma</i> ; <i>Faidherbia albida</i> ; <i>Falcataria moluccana</i> ; <i>Hardwickia binata</i> ; <i>Oryza sativa</i> (?) (Poaceae); <i>Parkinsonia praecox</i> ; <i>Piliostigma malabarica</i> ; <i>Poinciana regia</i> ; <i>Pongamia pinnata</i> ; <i>Prosopis africana</i> ; <i>P. alba</i> ; <i>P. chilensis</i> ; <i>P. cineraria</i> ; <i>P. farcta</i> ; <i>P. juliflora</i> ; <i>P. pallida</i> ; <i>Rhamnus purshiana</i> (?) (Rhamnaceae); <i>Senna alexandrina</i> ; <i>S. auriculata</i> ; <i>S. italica</i> subsp. <i>italica</i> ; <i>Tamarindus indica</i> ; <i>Terminalia arjuna</i> (?) (Combretaceae)
<i>skaifei</i>	Unknown.
<i>sparsus</i>	Unknown
<i>sudanensis</i>	<i>Senna alexandrina</i>
<i>uganda</i>	Unknown
<i>vinsoni</i>	Unknown
<i>yemenensis</i>	<i>Senna italica</i>
Species of <i>Afroredon</i>	Hosts
<i>africanus</i>	Unknown
<i>katanganus</i>	Unknown
<i>martini</i>	Unknown
<i>ritchiei</i>	Unknown
Species of <i>Caryotrypes</i>	Hosts
<i>minor</i>	Unknown
<i>pandani</i>	<i>Pandanus</i> (Pandanaeae)
Species of <i>Mimocaryedon</i>	Hosts
<i>freyi</i>	Unknown
Species of <i>Exoctenophorus</i>	Hosts
<i>deflexicollis</i>	Unknown

Table 2. Plants fed upon by species of Caryedontini. The host plants listed here are updated names. The names as written in the literature or on insect labels are listed under each species. Two valuable databases where current plant names can be obtained are ILDIS (International Legume Database and Information Service www.ildis.org) and Missouri Botanical Garden's Vascular Tropicos database (www.mobot.org). These databases are updated continuously, and highly reliable.

FABACEAE**Species of *Caryedon***

<i>Acacia ataxacantha</i> DC.	<i>pallidus</i>
<i>A. auriculiformis</i> Benth	<i>acaciae</i>
<i>A. borleae</i> Burt Davy	<i>acaciae</i>
<i>A. chundra</i> Willd.	<i>serratus</i>
<i>A. confusa</i> Merr.	<i>serratus</i>
<i>A. erioloba</i> E. Meyer	<i>multinotatus</i>
<i>A. farnesiana</i> (L.) Willd.	<i>acaciae; serratus</i>
<i>A. gerrardii</i> Benth.	<i>palaestenicus; serratus</i>
<i>A. horrida</i> (L.) Willd.	<i>interstinctus</i> (?)
<i>A. kochii</i> Ewart & J. White	<i>acaciae</i>
<i>A. leucophloea</i> (Roxb.) Willd.	<i>palaestenicus; serratus</i>
<i>A. nilotica</i> (L.) Delile	<i>acaciae; albonotatus; cassiae; interstinctus</i> (?); <i>longus; pallidus; serratus</i>
<i>A. nilotica</i> subsp. <i>adstringens</i> (Schum. & Thonn.) Roberty	<i>acaciae; albonotatus</i>
<i>A. nilotica</i> subsp. <i>nilotica</i> (L.) Delile	<i>acaciae</i>
<i>A. nilotica</i> subsp. <i>tomentosa</i> (Benth) Brennan	<i>acaciae; serratus</i>
<i>A. pennata</i> (L.) Willd.	<i>serratus</i>
<i>A. polyacantha</i> Willd.	<i>acaciae</i>
<i>A. polyacantha</i> subsp. <i>campylacantha</i> (A. Rich.) Brennan	<i>acaciae</i>
<i>A. reficiens</i> Wawra	<i>acaciae</i>
<i>A. senegal</i> (L.) Willd.	<i>serratus</i>
<i>A. seyal</i> Delile	<i>acaciae</i>
<i>A. sieberiana</i> DC.	<i>acaciae; albonotatus</i>
<i>A. tortilis</i> (Forssk.) Hayne	<i>acaciae; albonotatus; serratus</i>
<i>A. tortilis</i> subsp. <i>raddiana</i> (Savi) Brennan	<i>acaciae; palaestenicus; serratus</i>
<i>A. tortilis</i> subsp. <i>spirocarpa</i> (A. Rich.) Brennan	<i>serratus</i>
<i>A. tortilis</i> subsp. <i>tortilis</i> (Forsk.) Hayne	<i>palaestenicus; serratus</i>
<i>A. verec</i> Guill. & Perr.	<i>pallidus</i>
<i>A. verugera</i> auct.	<i>pallidus</i>
<i>Albizia lebbeck</i> L.	<i>serratus</i>
<i>Arachis hypogaea</i> L.	<i>acaciae; cassiae; longus; pallidus; serratus</i>
<i>Bauhinia acuminata</i> L.	<i>serratus</i>
<i>B. galpinii</i> N.E. Br.	<i>serratus</i>
<i>B. monandra</i> Kurz	<i>serratus</i>
<i>B. racemosa</i> Lam.	<i>serratus</i>
<i>B. reticulata</i> DC.	<i>crampeli; serratus</i>
<i>B. rufescens</i> Lam.	<i>cassiae; crampeli; serratus</i>
<i>B. thonningii</i> Schum.	<i>congensis; serratus</i>
<i>B. tomentosa</i> L.	<i>serratus</i>
<i>B. variegata</i> L.	<i>crampeli; serratus</i>
<i>Caesalpinia pulcherrima</i> (L.) Sw.	<i>serratus</i>
<i>Cajanus</i> sp.	<i>cassiae</i>
<i>Cassia arereh</i> Delile	<i>cassiae; serratus</i>
<i>C. brewsteri</i> F. Muell.	<i>serratus</i>
<i>C. fistula</i> L.	<i>serratus</i>
<i>C. foetida</i> Pers.	<i>serratus</i>

Table 2. (Continued)

<i>C. grandis</i> L. f.	<i>serratus</i>
<i>C. javanica</i> L.	<i>cassiae; serratus</i>
<i>C. javanica</i> L. subsp. <i>nodosa</i> (Roxb.) K. Larsen & S. Larsen	<i>cassiae; serratus</i>
<i>C. mimosoides</i> L.	<i>pallidus</i>
<i>C. montana</i> Heyne ex Rot	<i>serratus</i>
<i>C. moschata</i> Kunth	<i>serratus</i>
<i>C. muritura</i> auct.	<i>serratus</i>
<i>C. sieberiana</i> DC.	<i>cassiae; crampeli; pallidus; serratus</i>
<i>C. surattensis</i> (Burm. f.) Irwin & Barneby	<i>cassiae</i>
<i>C. tora</i> (L.) Roxb.)	<i>pallidus</i>
<i>Cassia</i> sp.	<i>maculipes; pallidus</i>
<i>Cassüs</i> sp.	<i>cassiae</i>
<i>Dialium guineense</i> Willd.	<i>dialii; serratus</i>
<i>D. pachyphyllum</i> Harms	<i>dialii</i>
<i>Delonix regia</i> (Hook.) Raf.	<i>cassiae; serratus</i>
<i>Erythrina monosperma</i> Lam.	<i>serratus</i>
<i>Faidherbia albida</i> (Del.) A. Chev.	<i>pallidus; longus; serratus</i>
<i>Falcataria moluccana</i> (Miq.) Barneby & Grimes	<i>serratus</i>
<i>Hardwickia binata</i> Roxb.	<i>serratus</i>
<i>Parkinsonia praecox</i> (Ruiz Lopez & Pavon) Hawkins	<i>serratus</i>
<i>Piliostigma malabaricum</i> (Roxb.) Benth.	<i>serratus</i>
<i>Pongamia pinnata</i> (L.) Pierre	<i>serratus</i>
<i>Prosopis africana</i> (Guillemin & Perrottet) Taubert	<i>cassiae; crampeli; dialii; longus; serratus</i>
<i>P. alba</i> Griseb.	<i>serratus</i>
<i>P. chilensis</i> (Molina) Stuntz	<i>longus; serratus</i>
<i>P. cineraria</i> (L.) Druce	<i>palaestinus; serratus</i>
<i>P. farcta</i> (Banks & Sol.) J. F. Macbr.	<i>palaestinus; serratus</i>
<i>P. juliflora</i> (Sw.) DC.	<i>serratus</i>
<i>P. pallida</i> (Willd.) Kunth	<i>serratus</i>
<i>Senna alata</i> (L.) Roxb.	<i>cassiae; crampeli</i>
<i>S. alexandrina</i> Miller	<i>pallidus; serratus; sudanensis</i>
<i>S. auriculata</i> (L.) Roxb.	<i>serratus</i>
<i>S. hirsuta</i> (L.) H. Irwin & Barneby	<i>cassiae</i>
<i>S. italica</i> Miller	<i>pallidus; yemenensis</i>
<i>S. italica</i> subsp. <i>italica</i> Miller	<i>pallidus; serratus</i>
<i>S. obtusifolia</i> (L.) H. Irwin & Barneby	<i>cassiae; pallidus</i>
<i>S. occidentalis</i> (L.) Link	<i>cassiae; maculipes; pallidus</i>
<i>S. podocarpa</i> (Guillemin & Perrottet) Lock	<i>cassiae</i>
<i>S. singueana</i> (Del.) Lock	<i>pallidus</i>
<i>Tamarindus indica</i> L.	<i>acaciae; longus; serratus</i>

APIACEAE

<i>Ferula communis</i> L.	<i>mesra</i>
<i>Lisaea heterocarpa</i> (DC.) Boiss.	<i>germari</i>

CASUARINACEAE

<i>Casuarina equisetifolia</i> L.	<i>serratus</i> (?)
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COMBRETACEAE

<i>Combretum cordofanum</i> auct.	<i>longipennis</i>
<i>C. ghasalense</i> Engl. & Diels	<i>fuliginosus; longipennis</i>

Table 2. (Continued)

<i>C. glutinosum</i> Perr.	<i>fuliginosus</i> ; <i>longipennis</i> ; <i>lunatus</i> (?)
<i>C. hartmannianum</i> auct.	<i>longipennis</i>
<i>C. hypopilinum</i> Diels	<i>atrohumeralis</i> ; <i>longipennis</i> ; <i>lunatus</i>
<i>C. lamprocarpum</i> Diels	<i>atrohumeralis</i> ; <i>conformis</i> ; <i>fasciatus</i> ; <i>longipennis</i>
<i>C. micranthum</i> G. Don	<i>immaculatus</i> ; <i>longipennis</i> ; <i>lunatus</i>
<i>C. molle</i> R. Br. ex G. Don	<i>longipennis</i> ; <i>lunatus</i>
<i>C. suluense</i> Engl. & Diels	<i>elongatus</i>
<i>Combretum</i> sp. probably <i>glutinosum</i>	<i>lunatus</i>
<i>Combretum</i> Loebl. sp.	<i>calderoni</i>
<i>Terminalia</i> L. sp.	<i>cassiae</i>
<i>Terminalia macroptera</i> Guill. & Perr.	<i>fathalae</i> ; <i>macropterae</i>
<i>T. arjuna</i> Wight & Arn.	<i>serratus</i>
PANDANACEAE	
<i>Pandanus</i> sp.	<i>Caryotrypes pandani</i> (?)
POACEAE	
<i>Oryza sativa</i> L.	<i>serratus</i> (?)
RHAMNACEAE	
<i>Rhamnus purshiana</i> DC.	<i>cassiae</i> (?); <i>serratus</i> (?)

DISTRIBUTION OF THE CARYEDONTINI

As with gathering reliable host plant information, comprehensive collecting and research studies of north, central and southern Africa and other areas where Caryedontini occur are needed. The general pattern in the past has been that of faunal studies limited to former colonies of European countries in Africa and in colonies in other areas of the world. More comprehensive studies of taxa are needed in similar biological areas or incorporating all of Africa. These kinds of studies would reduce the number of synonyms, produce reliable host plant, and distributional data, etc.

All indications are that Caryedontini had its origins in the Old World and is confined to the subtropical and tropical regions lying within the latitudes 45°N and 35°S. *Caryedon* has an extensive distribution outside the geographic range of this monograph. They are reasonably diverse through south and southeast Asia, including India, and at least to Hong Kong. One species, *Caryedon germari*, is on the periphery of this distribution. It has been reported to occur in Armenia, Caucasus, Crimea, Bulgaria, Georgia, Turkey, Greece, Dalmatia, Herzegovina, and Macedonia (Southgate 1971: 413, Borowiec 1990a: 387).

Caryedon acaciae, *C. albonotatus*, *C. cassiae*, *C.*

conformis, *C. dialii*, *C. interstinctus*, *C. longipennis*, *C. longus*, *C. maculipes*, *C. multinotatus*, *C. nigrosignatus*, *C. palaestinus*, *C. pallidus*, *C. yemenensis* (*C. palaestinus* and *C. yemenensis* have very similar distributions in or near Pakistan), and *Afroredon africanus* Decelle ostensibly have broad distributions according to the literature (see descriptions of each species). Of these species, *C. acaciae*, *C. cassiae*, *C. pallidus*, and *C. serratus* have more hosts published than the others (from 14 to 57 host plants) that could account for their broad distributions. *Caryedon serratus*, of course, has been spread throughout the tropical regions of the world by the agency of man. Of the remaining 11 species, none have a large number of host plants. It is possible, however, that they may have few hosts with wide distributions. Perhaps some were named so very long ago that they have been misidentified many times and thus have a published wide, but faulty distribution.

There are much more reliable distributional data for the recently described and new species described in this monograph. In areas in or near the Mediterranean Sea, the two new species *C. cyprus* and *C. mesra* are described. From northeast Africa are described *C. maculatus* Johnson, Southgate & Delobel, *C. meinanderi* Johnson, Southgate & Delobel, *C. nigrinus* Johnson, Southgate & Delo-

bel, and *C. sudanensis*. From central Africa are described *C. calderoni*, *C. sparsus* Johnson, Southgate & Delobel, *C. uganda* Johnson, Southgate & Delobel, and *Afroredon ritchiei* (Pic). Published distributions from east Africa are for the species *C. arenarum* Decelle, *C. grandis* Decelle, and *Afroredon katanganus* Decelle. Those with distributions published from only Madagascar are *C. alluaudi* (Allard), *C. amplipennis* (Fairmaire), *C. beniowskii* Borowiec, *C. denticulatus* (Klug), *C. gigas* Johnson, Southgate & Delobel, *C. johni* Borowiec, *Afroredon martini* (Pic), and *Exoctenophorus deflexicollis* Decelle. The distribution of *Caryotrypes pandani* (Blanchard) is in doubt but it could be from Madagascar (see description).

The new species *C. vinsoni* Johnson, Southgate & Delobel is only known from Mauritius.

The species from west Africa have reliable distributions and include *C. atrophumeralis*, *C. fasciatus*, *C. fathalae*, *C. fuliginosus*, *C. immaculatus*, *C. lunatus*, *C. macropterae*, and *C. proszynskii*.

The species from South Africa and Namibia are new and the distributions are reliable. These are *C. decellei* Johnson, Southgate & Delobel, *C. skaifei* Johnson, Southgate & Delobel, and *C. elongatus* Johnson, Southgate & Delobel.

Of course more studies need to be made on the genus *Caryotrypes* because of the species from Thailand, *Caryotrypes minor* Anton.

RELATIONSHIPS OF SPECIES GROUPS OF CARYEDON

Our present knowledge of the species groups of *Caryedon* is not based on what we consider to be evolutionary relationships, thus it is an artificial classification. More studies are needed using more characters such as the male genitalia and the ventral surfaces, especially the armature of the hind leg, to produce a more natural classification of the genus. This also applies to the other genera in the Caryedontini. Once these morphological studies are completed then molecular studies will add additional data to our knowledge of the group and the relationships of the taxa related to the Caryedontini.

CLADISTIC ANALYSES

In *Caryedon*, as in various other taxonomic groups of Chrysomeloidea (Farrell & Mitter 1990,

Funk *et al.* 1995), satisfactory explanations of insect-host plant interactions may be reached using cladistic methods in conjunction with ecological and biological studies. Silvain & Delobel (1998) took this approach to study the historical relationship between a group of 16 west African species and their hosts. Ten of these were legume feeders: six on Mimosoideae and four on Caesalpinioideae, the other six fed on Combretaceae: four on *Combretum* spp., two on *Terminalia macroptera*.

Thirty-three morphological characters of the adult and larva, plus one ecological character were used in the cladistic analysis. The plesiomorphic state of these characters was defined as the state found in Chrysomelidae or in bruchid genera considered as more ancient than *Caryedon*, such as *Pachymerus* or *Caryoborus*. Molecular characters were obtained from mitochondrial 12S ribosomal DNA, extracted and sequenced using standard techniques.

Statistical analysis of combined morphological and molecular distances between species yielded, with a reasonable degree of confidence, phylogenetic trees showing four main clades, each corresponding with the four larval diets of the 16 species: Mimosoideae, Caesalpinioideae, *Combretum*, and *Terminalia*. Besides results of traditional taxonomic and ecological studies (Johnson 1981, Borowiec 1987), this proved the close relationship existing between cladogenesis and host plant association.

However, molecular data pointed to two species which were placed in a clade grouping species with a different diet: *C. albonotatus*, a Mimosoid feeder, clustered with *Combretum* feeders, and *C. serratus*, a Caesalpinoid feeder, clustered with Mimosoid feeders.

Because of the present limited knowledge of the phylogeny of Combretaceae and Leguminosae, a direct test of congruence between *Caryedon* and host plant phylogeny could not be performed. However, the traditional hypothesis of a primitive bruchid non-legume diet was not contradicted. Among west African *Caryedon*, the ancestral feeding could be on Combretaceae.

Arguing based on ecological data, Delobel (2000) hypothesized that feeding on Mimosoideae was the primitive state among legume feeders. On this assumption, the caesalpinoid diet may have been acquired twice during the history of the genus, either by coevolution or more likely by simple radiation: once by a clade composed of *C.*

crampeli, *C. dialii* and *C. pallidus*, and more recently by the single species *C. serratus*. *Caryedon serratus* thus appears as a highly evolved species, with physiological and ecological advantages that enabled it to extend its diet to a papilionoid, *Arachis hypogaea*.

SYSTEMATICS OF CARYEDONTINI

CHECKLIST OF TAXA TREATED IN THIS PAPER

The following is a checklist of the taxa treated in this paper. The list is in alphabetical order. The valid species are in bold with synonyms in italics. The name in parentheses after each species is the original genus in which the specific name was described. New species and taxonomic changes are indicated in bold. Following this main checklist, we have presented a listing of the species of *Caryedon* within the species groups that we have used in this paper.

SUBFAMILY PACHYMERINAE

TRIBE CARYEDONTINI

Afroredon Decelle 1965

africanus Decelle 1965 (*Afroredon*)

katanganus Decelle 1965 (*Afroredon*)

martini (Pic 1898b) (*Caryoborus*)

ritchiei (Pic 1928) (*Pachymerus*)

serratus Decelle 1965 (*Afroredon*)

Caryedon Schoenherr 1823

acaciae (Gyllenhal in Schoenherr 1833) (*Bruchus*)

capicola (Motschulsky 1874) (*Caryoborus* (sic))

akdamaricus Decelle & Lodos 1989 (*Caryedon*) *Nomen nudum*

albonotatus (Pic 1898b) (*Caryoborus*)

albonotatus diversicolor (Pic 1921) (*Pachymerus*; as variety) Unrecognized

alluaudi (Allard 1895a) (*Caryoborus*)

amplipennis (Fairmaire 1902) (*Bruchus*) **New combination**

arenarum Decelle 1979b (*Caryedon*)

atrohumeralis Preveit 1965 (*Caryedon*)

beniowskii Borowiec 1990a (*Caryedon*)

brevelineatus (Pic 1950b) (*Pachymerus*) **New combination**; unrecognized

calderoni Johnson, Southgate & Delobel (*Caryedon*) **New species**

cassiae (Gyllenhal in Schoenherr 1833) (*Bruchus*)

minutus (Pic 1902a) (*Caryoborus*)

conformis (Fåhræus 1871) (*Bruchus* subgenus *Caryoborus*)

congensis Decelle 1951 (*Caryedon*)

crampeli (Pic 1924a) (*Pachymerus*)

cyprus Johnson, Southgate & Delobel (*Caryedon*) **New species**

decellei Johnson, Southgate & Delobel (*Caryedon*) **New species**

denticulatus (Klug 1833) (*Bruchus* subgenus *Caryoborus*)

dialii Decelle 1973 (*Caryedon*)

elongatus Johnson, Southgate & Delobel (*Caryedon*) **New species**

fasciatus Preveit 1965 (*Caryedon*)

fathalae Delobel 1997 (*Caryedon*)

fuliginosus Preveit 1965 (*Caryedon*)

germari (Küster 1845) (*Caryoborus*)

lisaeae Southgate 1971 (*Caryedon*)

gigas Johnson, Southgate & Delobel (*Caryedon*) **New species**

grandis Decelle 1979b (*Caryedon*)

immaculatus Preveit 1965 (*Caryedon*)

interstinctus (Fåhræus 1871) (*Bruchus* subgenus *Caryoborus*)

johni Borowiec 1990b (*Caryedon*)

kivuensis Decelle 1951 (*Caryedon*)

longipennis (Pic 1898a) (*Caryoborus*)

combreti Preveit 1965 (*Caryedon*)

longus (Pic 1902c) (*Caryoborus*)

lunatus Preveit 1965 (*Caryedon*)

macropterae Delobel 1997 (*Caryedon*)

maculatus Johnson, Southgate & Delobel (*Caryedon*) **New species**

maculipes (Pic 1911) (*Caryoborus*)

mauritanicus Decelle 1979a (*Caryedon*) *Nomen nudum*

meinanderi Johnson, Southgate & Delobel (*Caryedon*) **New species**

mesra Johnson, Southgate & Delobel (*Caryedon*) **New species**

multinotatus (Pic 1935) (*Pachymerus*; as variety of *albonotatus*)

nigrinus Johnson, Southgate & Delobel (*Caryedon*) **New species**

nigrosignatus (Pic 1902b) (*Caryoborus*)

atricolor (Pic 1924b) (*Pachymerus*) **New synonymy**

palaestinus Southgate 1976 (*Caryedon*; as subspecies of *serratus*)

pallidus (Olivier 1790) (*Bruchus*)

pallidus annulicornis (Pic 1950a) (*Pachymerus*; as variety of *pallidus*)

proszynskii Borowiec 1990a (*Caryedon*)

sahelicus Decelle 1979a (*Caryedon*) *Nomen nudum*

serratus (Olivier 1790) (*Bruchus*)

gonagra (Fabricius 1798) (*Bruchus*)

tamarindi (Decaux 1894) (*Caryoborus*) **New synonymy**

notativentris (Pic 1924a) (*Pachymerus*)

sibutensis (Pic 1924a) (*Pachymerus*)

irakensis Al-Ali & Ali 1988 (*Caryedon*) **New synonymy**

skaifei Johnson, Southgate & Delobel (*Caryedon*) **New species**

sparsus Johnson, Southgate & Delobel (*Caryedon*) **New species**

sudanensis Southgate 1971 (*Caryedon*)

uganda Johnson, Southgate & Delobel (*Caryedon*) **New species**

vinsoni Johnson, Southgate & Delobel (*Caryedon*) **New species**

yemenensis Decelle 1979a (*Caryedon*)

Caryotrypes Decelle 1968

minor Anton 1999 (*Caryotrypes*)

pandani (Blanchard 1845a) (*Pachymerus*)

Exoctenophorus Decelle 1968

deflexicollis Decelle 1968 (*Exoctenophorus*)

Mimocaryedon Decelle 1968

freyi Decelle 1968 (*Mimocaryedon*)

SPECIES GROUPS OF CARYEDON AND THEIR INCLUDED SPECIES

Acaciae Group: *acaciae* (Gyllenhal); *arenarum* Decelle; *calderoni* Johnson, Southgate & Delobel; *cassiae* (Gyllenhal); *congensis* Decelle; *crampeli* (Pic); *cyprus* Johnson, Southgate & Delobel; *dialii* Decelle; *fathalae* Delobel; *germari* (Küster); *gigas* Johnson, Southgate & Delobel; *immaculatus* Preveitt; *kivuensis* Decelle; *macropterae* Delobel; *maculipes* (Pic); *mesra* Johnson, Southgate & Delobel; *nigrinus* Johnson, Southgate & Delobel; *nigrosignatus* (Pic); *pallidus* (Olivier); *proszynskii* Borowiec; *skaifei* Johnson, Southgate & Delobel; *sparsus* Johnson, Southgate & Delobel; *sudanensis* Southgate; *uganda* Johnson, Southgate & Delobel; *yemenensis* Decelle.

Amplipennis Group: *amplipennis* (Fairmaire).

Denticulatus Group: *denticulatus* (Klug); *vinsoni* Johnson, Southgate & Delobel.

Longipennis Group: *atrohumeralis* Preveitt; *elongatus* Johnson, Southgate & Delobel; *longipennis* (Pic); *lunatus* Preveitt.

Serratus Group: *conformis* (Fåhræus); *fasciatus* Preveitt; *fuliginosus* Preveitt; *grandis* Decelle; *johni* Borowiec; *longus* (Pic); *maculatus* Johnson, Southgate & Delobel; *meinanderi* Johnson, Southgate & Delobel; *palaestinus* Southgate; *serratus* (Olivier).

Interstinctus Group: *albonotatus* (Pic); *decellei* Johnson, Southgate & Delobel; *interstinctus* (Fåhræus); *multinotatus* (Pic).

Alluaudi Group: *alluaudi* (Allard); *beniowskii* Borowiec.

SUBFAMILY PACHYMERINAE

According to Nilsson & Johnson (1993) the subfamily Pachymerinae differs from other members of the family Bruchidae in having a metafe-mur with a pecten and often also with spines, and the disc of the pronotum with a surrounding (or almost so) impressed marginal line.

TRIBE CARYEDONTINI

Caryedini Bridwell 1929: 143; Nilsson & Johnson 1993: 9.

Caryedontini Decelle 1966: 172; Udayagiri & Wadhi 1989: 226.

Description.—*General facies:* Body elongate or oval (Figs. 3, 4, 5, 6, 7, 8), usually comparatively small pachymerines (2–8 mm); integument usually reddish-fuscos with or without maculations, usually obscured to some extent by setae varying in density and color.

Head: Short, often concealed from above; clypeus approximately square, surface usually reticulate to punctate; eyes entire or almost so, covering more than 0.75 of head; eye facets of medium size, extending to both dorsal and ventral sides of head, postocular lobe short, ocular sinus vague; usually well-defined longitudinal, median carina, extending from frontoclypeal suture to apex; surfaces on sides of carina usually reticulate, with long setae that extend medially, sometimes obscuring carina; antennae inserted below lateral thickening of frons at apical edge of eyes (Fig. 6), some with eyes with very slight indentation at this point; antennae (Fig. 3) with segments 1–4 rounded; segments 5–10 serrate, with little difference between sexes, apical segment acuminate.

Pronotum: Subrectangular, transverse, disk not lobed on basal margin, lateral carina variable, in some genera extending from base to apex, in some not; if incomplete usually strong at posterior end, tapering, obsolete at anterior end; surface evenly convex, usually without impressed lines or depressed areas; integument usually with large and unevenly spaced punctures; pubescence varies from sparse setae to uniform setae almost obscuring integument.

Scutellum: Small, in most species slightly longer than broad (Fig. 3), surface usually with dense setae completely obscuring surface.

Elytron: Elongate, usually covering only base of pygidium, striae well defined, punctate, strial pattern often different between genera and species; surface between striae reticulate, sometimes unicolorous or with irregular maculations; with sparse to uniform dense pubescence; some species with long, curved setae arising from strial punctures standing erect above other setae; in some species pubescence forming pattern of longitudinal stripes because pubescence on interstices 1, 3, 5, 7 and 9 is much longer, thicker and erect toward center of interstice.

Legs: Conform to general pattern of Bruchidae, with pairs 1 and 2 with femora arising from ellipsoid coxae, slender tibiae and 4-segmented tarsi, ending in twin claws (Figs. 9, 10); hind legs typically pachymerine in that metafemur is incrassate, usually longer than broad, ventral ridge usually pectinate (Figs. 1, 2, 11); femoral pecten usually with one large, medial, ventral spine approximately 0.33 from apex (Fig. 1), followed by several smaller spines, usually decreasing in size toward apex; usually, basal to pecten, a prepectal ridge present consisting of a number of serrations; in one group of species serrations larger and similar to spines of pecten (e.g., Fig. 2); hind femora may bear maculations similar to elytra if a species is so marked; in *Caryedon interstinctus* hind legs very strongly marked, as is remainder of insect, covered with broad adpressed setae of varying colors; metatibia carinate, mucronate; tarsi five segmented and end in bifid claw; integument of legs 1 and 2 pale testaceous to reddish-fuscous, sparsely overlaid with fine setae; wings intermediate between Pachymerinae (Figs. 12a, b) and Bruchinae (Figs. 13a, b); radial veins well developed, with linkage between radial veins and media; cubitus extends about 0.5 length from wing base; curved, apical end of cubitus joins the media, which projects backward and parallel to cubitus for a short distance toward base, midway between radial and cubitus; apical end of cubitus branches downward to anterior edge of wing, weakening as it does so; anal vein weakly sclerotized and although there is no evidence of a true anal cell, in *Caryedon* (Fig. 12a) there is a weak T-shaped anal vein that may correspond to the anterior cell boundaries seen in *Pachymerus* (Fig. 13a).

Pygidium: Partially covered by elytra; general shape elongate, more strongly so in males, extending at an angle of 30–40 degrees to the hori-

zontal, surface flat or even convex, rigid, punctate, adorned with setae that in some species form a pattern; females of eight species of *Caryedon* (*albonotatus*, *alluaudi*, *decellei*, *immaculatus*, *interstinctus*, *multinotatus*, *sudanensis*, *yemenensis*) with a unique, medial tubercle near apex on dorsal surface of pygidium (Fig. 139), tubercle covered with setae with their apices pointing toward apex of tubercle.

Male genitalia: The lateral lobes, the basal piece, and the tegminal strut are fused into one structure, the tegmen, which serves as a muscle and membrane attachment and as a guiding mechanism for the median lobe (Fig. 14). The basal piece surrounds the median lobe, supporting the median lobe are a pair of lateral arched supports that are strongly sclerotized and curve basally inward becoming less strongly sclerotized as they curve; median lobe lightly sclerotized, with ventral and dorsal valves usually at apex, valves exhibit variation on basic triangular shape from truncated or evenly rounded apices to broadly spatulate tubes arising from an angular base; inside median lobe an eversible internal sac that is usually lined with an armature of small spines and a series of paired hooks and rods and larger spines; armatures exhibit considerable diversity of shape between taxa, varying in number from none to as many as 6 pairs of heavily sclerotized hooks and a number of smaller elongate rods with pointed ends; hooks and rods usually arranged in pairs one behind the other along length of median lobe; dorsally attached basal piece extends apically eventually dividing to form lateral lobes; setae fringe apices of lateral lobes that are usually separated by a median cleft; size and arrangement of setae and depth of median cleft vary between species; apex of internal sac extends into entrance of well-defined ejaculatory duct, entrance ornamented with various spines which appear to vary consistently with the species, ranging from a simple, lightly sclerotized ring to a much more complex structure (Fig. 14).

Female genitalia: Similar to other Bruchidae with generally similar pear-shaped, very thinly sclerotized saccular bursa copulatrix, majority of species bear varying numbers of denticulate structures on surface of bursa; some species more ornamented than others and may have in addition an apical beard-like extension that appears to be composed of either strong setae or thin spines; neck

end of bursa copulatrix extends toward vagina, narrowing as it does so; constriction of the neck has within it a number of sclerotized structures that appear to function as tubes or may be simply strongly sclerotized areas that serve to keep neck from collapse; vagina with a number of strongly sclerotized sclerites that are constant in shape for a species; spiculum ventrale and ovipositor with constant shape; basal ends of ovipositor lobes varying from heavily to lightly sclerotized.

Discussion.—According to Nilsson & Johnson (1993) the tribe Caryedontini differs from the other two tribes of Pachymerinae, Caryopemini and Pachymerini, in having an ocular sinus that is not well-marked, eyes that are coarsely faceted, a short postocular lobe, vestiture usually of a uniform color, a prosternal process that is narrow if it completely separates the procoxae or acute if it does not completely separate the procoxae, segments one of the protarsus and metatarsus that are only feebly expanded triangularly at apex, and a body that is usually between 4 to 7 mm in length, but varies to 2 to 8 mm in length. The Caryedontini are highly variable in size including some of the largest indigenous species in the Old World.

Sexual dimorphism in the Caryedontini is not as marked as in some other members of the Bruchidae. Males are usually smaller than females but not markedly so. The males and females have slight differences in the shape of the antennae but these are very slight and cannot be used to determine the sex of a species. Variation does occur, however, in the shape of the pygidium and in the shape of the last abdominal sternum that is considerably shorter in the male and the apex is directed downward (Davey 1958).

The wings of the Bruchidae have been little studied in the past both in relation to structure and relative size. It is not within the scope of this paper to make comparisons between all the tribes of the Bruchidae, but simply to note how far wing venation bears out classificatory ideas based on other characters. The wings (Figs. 12, 13) may prove to have structures with reliable characters to justify further for a better classification of the Bruchidae. Southgate (unpublished) has observed that the degree of variation of sclerotization in the various genera is striking, as is the surface microstructure. Both of these aspects warrant detailed investigation.

KEY TO GENERA OF THE TRIBE CARYEDONTINI
[after Nilsson & Johnson 1993]

1. When hind leg flexed, tibia positioned on medial side of pecten; pecten denticle 1 on metafemur not large and acuminate; two apical tubercles on apical side of pecten; tibia with tubercle near base (Fig. 11) *Exoctenophorus* Decelle
- When hind leg flexed, tibia positioned on lateral side of pecten; pecten denticle on metafemur large and acuminate; no apical tubercles; tibia without tubercle near base (Fig. 15) 2
- 2(1). Prosternum completely separating procoxae; apex of prosternal process narrow but not acute (Fig. 16); elytral stria 1 (stria closest to the meson) bending away from the meson posterior to the apex of the scutellum (Fig. 18), stria continuing past apex of scutellum to near the basal margin of the elytron; striae 2 and 9, and usually striae 3 and 8 usually joined at the apex of elytron; lateral carina of pronotum complete 3
- Prosternum not completely separating procoxae; apex of prosternal process acute (Fig. 17); elytral stria 1 not bending away from the meson posterior to the apex of the scutellum (Fig. 19), but continuing to slightly posterior to apex of scutellum; stria 2, 3, 8 and 9 not joined at the apex of elytron (often hard to see under setae); lateral carina of pronotum complete or incomplete 4
- 3(2). Body rounded (Fig. 6); length of abdominal sternum 1 about 1.5 times the combined length of sterna 2–5; females with a glabrous field between elytral stria 9 and 10 near humerus (Fig. 6) . . . *Afroredon* Decelle
- Body elongate (Fig. 4); length of abdominal sternum 1 about equal to the combined length of sterna 2–5; females without a glabrous field between elytral stria 9 and 10 near humerus . . . *Mimocaryedon* Decelle
- 4(2). Lateral carina of pronotum incomplete (Fig. 20), strong at base, tapering, obsolete at apex; body moderately oval (Fig. 3) *Caryedon* Schoenherr
- Lateral carina of pronotum complete, extending from base to apex; body elongate (Fig. 5) *Caryotrypes* Decelle

GENUS *CARYEDON* SCHOENHERR

Caryedon Schoenherr 1823:1134. Type species: *Bruchus serratus* Olivier 1790, by original designation; Udayagiri & Wadhi 1989: 226; Nilsson & Johnson 1993: 10.

Pachymerus Thunberg: Pic 1913: 6 (*Caryedon* as subgenus of *Pachymerus*).

Description.—*General facies:* Moderately oval beetles (Fig. 3). Integument usually medium to dark brown, usually with irregular, darker, almost black markings, setae often dense, uniformly brownish white or pale brown.

Head: Short, constricted behind eye; vertex usually with sharp median carina, glabrous or partly covered by setae; eye large, bulging, extending to both dorsal and ventral sides of head; ocular sinus almost nonexistent; submentum tapering, posterior part moderately wide, sides parallel; antennal segments 5–10 serrate.

Pronotum: Subrectangular, transverse, base slightly wider than apex; disk with surrounding impressed marginal line, line sometimes weak or obsolete along apical margin; lateral carina incomplete, not extending from base to apex, strong at base, tapering, obsolete at apex; prosternum with short process, not completely separating procoxae.

Scutellum: Square, not truncate apically.

Elytron: Elongate, approximately three times longer than wide, females without a glabrous field between elytral stria 9 and 10 near humerus; mesosternum with long process, not cleft.

Metafemur: Incrassate, elongate; dorsal side not granulate; ventral side pectinate; pecten with denticles, denticle 1 usually acuminate, usually slightly larger than the other denticles, located beyond middle of femur; when leg flexed, tibia positioned on lateral side of pecten; prepectenal ridge long, with spines, without protuberance (Fig. 1); metatibia arcuate; three strong ventral carinae, middle carina without tubercle and without sulcus; with lateral but without dorsolateral carinae; with mesal but without dorsomesal carinae; mucro at apex, without apical calcaria.

Male genitalia: Median lobe broad with basal hood broad, with both dorsal and ventral valve (dorsal valve absent in all other *Pachymerinae*

genera), usually with median and apical sclerites (Figs. 21, 22). Lateral lobes confluent, not separated, with small medial cleft (Fig. 14).

Discussion.—Of the other genera in the tribe, *Caryedon* most closely resembles *Caryotrypes* in its external features. They share characters given in the key to genera but the most obvious are a prosternum that does not completely separate the procoxae and the apex of the prosternal process being acute (Fig. 17). In addition, *Caryedon* has a lateral carina of the pronotum that is incomplete (Fig. 20), strong at the base, tapering, and obsolete at the apex, and the body is more oval (Fig. 3), *Caryotrypes* has a lateral carina on the pronotum that is complete, extending from the base to the apex, and the body is more elongate (Fig. 5).

It was originally intended at the outset of this revision that a key to species would be produced for the tribe. This has proved to be impractical, however, for a number of reasons. The most important is the lack of reliable external characters that will facilitate the separation of one species from another.

After much deliberation, it was concluded that a partial solution to the problem lay in the production of a key to species groups. These had become apparent during the course of the investigation into the taxonomy of the tribe. Having placed a species within a group, the only sure way to determine its identity is to examine the genitalia. An attempt to produce a key to species based on genitalia was impractical.

The six groups that we found have been based primarily on the form of the pubescence and the presence or absence of maculate areas on the integument. Even species group arrangements have their limitations. In a tribe where the species are as variable as they are in the *Caryedontini*, it is always possible that an aberrant individual may fall into the wrong group based on the selected characters. Then examination of the genitalia may be used to identify them.

Because of the tentative nature of the species groups, in the text of the paper the species are arranged alphabetically rather than by group in order to make information concerning individual species more easily accessible to the reader.

KEY TO SPECIES GROUPS OF *CARYEDON*

1. Prepectenal ridge and pecten of hind femur with denticles approximately equal in length and number on both sides of the first spine of pecten (Fig. 23) *Denticulatus* Group
- Prepectenal ridge of hind femur without denticles or at most a number of serrations 2
- 2(1). Elytra without maculations or pubescence on integument or at most with indefinite darker lines on thorax or elytra (Fig. 140) *Acaciae* Group
- Elytra with clearly defined maculations 3
- 3(2). Maculations confined to one or two clearly defined areas on elytra (Fig. 141) *Longipennis* Group
- Whole insect more strongly marked 4
- 4(3). Elytra with stria punctures very large, not longitudinally confluent (Fig. 142); elytral pubescence strongly adpressed, dense *Amplipennis* Group
- Elytra with stria punctures smaller, confluent, often obscured; elytral pubescence not adpressed, usually less dense 5
- 5(4). Elytra, hind femora and sometimes thorax with randomly arranged light or dark maculations (Fig. 143) *Serratus* Group
- Elytra with well defined pattern 6
- 6(5). Elytral maculations of integument and pubescence forming a herringbone pattern along sutural line (Fig. 144) *Interstinctus* Group
- Elytra with pubescence of alternate interstices thicker giving the appearance of longitudinal stripes (Fig. 145) *Alluaudi* Group

Caryedon acaciae (Gyllenhal)

Figs. 25, 27

Bruchus acaciae Gyllenhal in Schoenherr 1833: 97 (Syn-types: Dongola Arabia; NRS).

Pachymerus acaciae: Pic 1913: 8 (as junior synonym of *pallidus* Olivier?); Shomar 1963: 189; Kaszab 1967: 4.

P. acaciae: Hoffmann 1945: 95; Yus Ramos 1976b: 192. Incorrect subsequent spelling.

Caryedon acaciae: Zacher 1952: 469; Davey 1958: 385; Smith & Brower 1974: 323; Vazirani 1975: 753; Arora 1977: 104, 1978: 38; Decelle 1979a: 328; Pfaffenberger 1985: 1; Van Tonder 1985: 147; Johnson 1985: 209; Zampetti 1988: 107; Udayagiri & Wadhi 1989: 227; Borowiec 1990a: 374, 1990b: 61; Delobel *et al.* 1995b: 81; Anton 1994b: 143, 1998: 74; Silvain & Delobel 1998: 534.

C. acaciae: Singh 1978: 199. Incorrect subsequent spelling.

Caryedon (sic) *capicola* Motschulsky 1874: 248 (Holotype ♀: Cap de Bonne-Espérance; ZMUM, according to Decelle 1975: 24).

Pachymerus capicola: Pic 1913: 7.

Caryedon capicola: Decelle 1975: 24, 1979a: 328; Van Tonder 1985: 147; Udayagiri & Wadhi 1989: 227; Borowiec 1990a: 374.

Description.—*General facies*: Overall testaceous, pubescence of white setae sparsely de-

posited; very similar to *C. serratus*. Length 3.5–6.8 mm. Width 1.8–3.0 mm.

Head: Fusco-testaceous, median carina present, prominent, surface on either side rugose; overlaid with sparse white setae; eyes fairly narrow, with small facets, distance between them at apex equal to length of antennal segment 2; antenna with segments 1–4 rounded, segment 1 twice as long as segment 2, segments 5–10 slightly longer than broad, subserrate, apical segment, evenly acuminate, antenna testaceous.

Pronotum: Transverse, lateral margins with basal 0.66 straight, apical 0.33 acutely conical; integument fusco-testaceous, with faint maculations scattered over integument; surface punctate, overlaid with white pubescence.

Scutellum: Elongate, narrow, covered with white pubescence.

Meso- and Metathorax: Elytra together slightly longer than broad; integument testaceous, overlaid with golden pubescence almost obscuring integument, apices rounded; legs 1 and 2 testaceous, hind pair fusco-testaceous with some ferruginous areas on hind femora and tibia; prepectenal ridge of hind femur with very small serrations.

Pygidium: Very large, as long in females as in

males, lateral margins rounded, male with evenly rounded apex, broader than long; integument testaceous overlaid with golden pubescence

Male genitalia: (Fig. 24). Median lobe short and broad; ventral valve with lateral margins sclerotized, concave, narrowing to acuminate apex, dorsal valve broader, with concave lateral margins narrowing to slightly blunt apex; armature of internal sac with 8 large and 10+ smaller spines arranged as follows: internal sac armed with 8 large spines near base with pair of large, broad, curved, but sharply pointed spines, and another pair of short, broad, pointed spines slightly apical to first pair, just apical to these spines a group of slender spines, consisting of two long straight spines flanked on either side by a very long thin spine with a U-shaped base, overlying all of these is a clump of more than 10 small, arrowhead-shaped spines, each with its apical end tucked into basal end of another short spine basal to it; entrance to ejaculatory duct campanulate with slight ornamentations of very small spines (Fig. 24); lateral lobes narrow basally, expanding to broad apices separated by slight medial cleft; apices flat at apex, with angulate lateral margins, apices with many, elongate setae.

Female genitalia: (Figs. 25, 26, 27). Sclerotized ventral plaques and bursa copulatrix (Fig. 25), abdominal tergite (Fig. 26), spiculum ventrale (Fig. 27).

Host Plants.—*Old records:* *Acacia auriculiformis* (Arora 1977: 105, Udayagiri & Wadhi 1989: 227); *A. borleae* (Van Tonder 1985: 147); *A. farnesiana* (Shomar 1963: 191; Udayagiri & Wadhi 1989: 227); *A. kochii* (Decelle 1979a: 328, Udayagiri & Wadhi 1989: 227); *A. nilotica* (as *A. arabica* (Udayagiri & Wadhi 1989: 227)); *A. nilotica* subsp. *adstringens* (as *A. n. adansonii* (Guill. & Perr.) Brenan: Decelle 1979a: 328, Udayagiri & Wadhi 1989: 227; Delobel *et al.* 1995: 81); *A. nilotica* subsp. *nilotica* (Decelle 1979a: 328, Udayagiri & Wadhi 1989: 227); *A. nilotica* subsp. *tomentosa* (Delobel *et al.* 1995: 81); *A. polyacantha* (Decelle 1979a: 328, Delobel *et al.* 1995: 81); *A. polyacantha* subsp. *campylacantha* (Decelle 1979a: 328, Udayagiri & Wadhi 1989: 227); *A. reficiens* (Van Tonder 1985: 147); *A. seyal* (Decelle 1979a: 328, Udayagiri & Wadhi 1989: 227; Delobel *et al.* 1995: 81); *A. sieberiana* (Delobel *et al.* 1995: 81); *A. tortilis* (Decelle 1979a: 328, Udayagiri & Wadhi 1989: 227); *Acacia tortilis* subsp. *raddiana* (as *Acacia raddiana* Savi: Delobel *et al.* 1995: 81);

Arachis hypogaea (Zacher 1952: 474, Cancela da Fonseca 1956: 9, Lukianovich & Ter-Minasian 1957: 35, Davey 1958: 388, Udayagiri & Wadhi 1989: 227); *Tamarindus indica* (Davey 1958: 387).

New records: None.

Distribution.—Dongola Arabiae. Cap de Bonne-Espérance (Cape of Good Hope). Mauritania, Senegal, Upper Volta, Tchad, Northern Cameroon, Sudan, Kenya, Tanzania, Rwanda, southeastern Zaïre (now Democratic Republic of the Congo), Transvaal, Natal, Swaziland, Mozambique, South-West Africa (Namibia) (Decelle 1975: 25, 1979a: 328). Niger, Somalia, Namibia, Zambia (Borowiec 1990a: 374). Saudi Arabia (Decelle 1979a: 328). Sudan, Angola (Yus Ramos 1976b: 193). South Africa (Van Tonder 1985: 147). Ethiopia (Zampetti 1988: 107). Southern Arabia, Jordan, Iran (Anton 1998: 74). Egypt (Vazirani 1975: 753). India (Arora 1977: 105).

Discussion.—*Caryedon acaciae* is in the *Acaciae* Group, subgroup 1. *Caryedon acaciae* and other members of the *Acaciae* Group are distinguished from other species of *Caryedon* by having elytra without maculations or pubescence on the integument or at most with indefinite darker lines on the thorax or elytra (Fig. 140). *Caryedon acaciae* differs from all other species of *Caryedon* and forms its own subgroup because of the distinct armature with many spines in the internal sac of the male genitalia (Fig. 24).

Caryedon acaciae was tentatively synonymized with *C. pallidus* presumably based on the description (Pic 1913). It is doubtful if Pic ever saw the type material. The syntype male is in a very poor state of preservation and externally could be mistaken for *C. pallidus*. Dissection of the genitalia, however, shows that the two species are quite distinct (compare Fig. 24 and Fig. 97, and see above).

This syntype for the species and one other specimen are the only examples that we were able to examine. According to several authorities consulted by BJS, there appears to be no record of the type locality in Arabia. The only "Dongola" on older maps appears along the banks of the Nile with the possibility of one other site on the Egyptian Red Sea coast. This raises doubts as to the accuracy of the locality recorded by Gyllenhal (Dongola Arabiae). It is more probable that the Dongola in Sudan is the original locality particularly as the only other record of the species is also African, from Ukerewe Island, Lake Victoria, Tan-

zania. Several authors have listed distributions for *C. acaciae* (see Distribution above). According to these authors, it occurs from South Africa to North Africa, the Middle East to Iran and India. The wide distribution suggests either that *C. acaciae* does indeed have a broad distribution or that there have been multiple misidentifications of the species. We suggest that the reported distribution is due to a combination of both of these factors.

First Decelle (1979a: 328), then Van Tonder (1985), synonymized *C. capicola* with *C. acaciae*. Borowiec (1990a) agreed with them.

Cancela da Fonseca (1956) studied the ecology and physiology of a bruchid he called *C. acaciae* that fed in the seeds of peanuts, but this was probably *C. serratus*.

The *Acaciae* Group contains 25 species, more than any other species group of *Caryedon*. These species are divided into nine subgroups based primarily upon the structure of the male genitalia of species within a group. A discussion of all subgroups and species within each subgroup follows.

Subgroup 1 consists of only *C. acaciae* because of its unique pattern of armature of the internal sac described above (Fig. 24).

Subgroup 2 of the *Acaciae* Group consists only of one species, *C. calderoni*, because of the armature of the internal sac of the male genitalia. The distinctive armature has a large medial plate with 2 spine-like processes on it that distinguishes it from all other species of *Caryedon* known to us (Fig. 35).

Subgroup 3 of the *Acaciae* Group is also composed of one species, *C. skaifei*. This species has a distinct shape of the ventral valve with the apex broadly rounded (Fig. 103). The ventral valves of most species in the *Acaciae* Group have acuminate apices or the ventral valves are narrow with a narrow, truncate apex. Of probably greater significance is that the armature of the internal sac consists of many large spines, several smaller spines and spinules extending from the base to near the apex as follows: near the base are 3 pairs of short, curved spines with broad, spatulate bases, there are 2 spines lateral to these, but immediately apical to the curved spines are about 15 slightly smaller to much smaller spines, and directly apical to these a series of about 8 or more smaller spines embedded in a mass of spinules, and all of internal sac is lined with many small spinules, with shapes that vary in different parts of the sac (not all drawn in Fig. 103).

Subgroup 4 is composed of *C. nigrinus* that has an armature of the male internal sac that is different from all species of *Caryedon* known to us. The armature has 7 spines as follows: medially a complex array of spines and hooks, consisting of two main double-pronged spines broadened at their bases, apical to these are a pair of long, narrow, recurved spines with somewhat broadened ends, then medial to these a pair of elongate, thin, curved spines, and laterally one narrow spine with a broad base and a pointed end, then a conglomeration of very small spines surrounding and obscuring parts of the most significant armature (Fig. 93).

Each species in Subgroup 5 has a narrow to very narrow ventral valve with acuminate to truncate apices and from 8 to 12 spines in the internal sac. *Caryedon arenarum* (Fig. 32), *C. sparsus* (Fig. 104), *C. dialii* (Fig. 47), and *C. sudanensis* (Fig. 105) all have 8 spines in the internal sac. *C. yemenensis* (Fig. 109) and *C. crampeli* (Fig. 40) have 10 and *C. cassiae* (Fig. 36), *C. congensis* (Fig. 39), *C. kivuensis* (Figs. 77, 78), *C. maculipes* (Fig. 87) and *C. proszynskii* (Fig. 99) have 12.

Caryedon arenarum is similar to *C. acaciae* in its external appearance but they differ dramatically in the structure of the male genitalia. *C. arenarum* differs from all others in this subgroup by having a heart-shaped dorsal valve and the very narrow, slightly elongate ventral valve. *Caryedon sparsus* has a narrower base and more elongate ventral valve than do *C. dialii* and *C. sudanensis*. The truncate apex of the ventral valve of *C. sudanensis* and the armature of the internal sac separate it from *C. dialii*.

Caryedon sudanensis is very similar in all its structures to *C. yemenensis* and *C. crampeli* except that the latter two have 10 spines in the internal sac. The differences between *C. crampeli* and *C. yemenensis* are subtle. The apex of the median lobe of the male genitalia is blunt and the shape of the ventral valve is in a gentler curve and less blunt at its apex in *C. crampeli*. The armature of the internal sac is similar between the two species but the shape and size of the spines are different, especially the shape of the two much smaller spines near base of large spines at the base of the sac (Figs. 40, 109).

Caryedon proszynskii has a small and uniformly colored body that allies it to *C. pallidus* and its relatives. It differs distinctly, however, in structure of the male genitalia with 12 spines (in *C. pallidus*

there are only 6), the third pair of spines is large, hook-like (in *C. pallidus* these spines are small and straight). The spines in *C. cassiae* are generally similar to this species but the last pair of spines is arched while in *C. prozyskii* these sclerites are straight. *Caryedon cassiae* is distinct from other members of this subgroup because of its much longer, narrower ventral valve that ends with an acuminate apex (Fig. 36). The basal spines in the internal sac of *C. maculipes* are thinner and more elongate than those of *C. prozyskii* and *C. kivuensis* (Figs. 77, 78). The small, median, apical spines of *C. prozyskii* are distinctly different from other species in the subgroup (Fig. 99). The ventral valve and the median lobe of the male genitalia of *C. kivuensis* are gently rounded as opposed to blunt apices of *C. maculipes*, *C. congensis* (Fig. 39) and *C. prozyskii*. The spines in the internal sac of *C. congensis* are generally similar to *C. kivuensis*, *C. prozyskii* and *C. maculipes*, but are more robust in their structure, more sclerotized, and differ in size and shape, especially the large, basal spines (Figs. 39, 77, 78, 99, 87). Externally, *C. congensis* differs significantly from *C. maculipes*. Antennal segments three to four are almost the same size in *C. maculipes*, whereas in *C. congensis* segment three is about 1.5 times longer than segments two and four. In addition, the number and size of spines and denticles on the femoral pectens differ significantly. On the pecten of *C. congensis*, the first spine is about two times longer than the apical 14–17 denticles. In *C. maculipes*, the first spine of the femoral pecten is only slightly larger than the apical 12 denticles.

Species in Subgroup 6 have four or six spines in the internal sacs of the male genitalia. The ventral valves of all species have acuminate apices. The internal sac of *C. immaculatus* (Figs. 67, 152) separates it from other species in the group because it has only four spines. The male genitalia of *C. cyprus* (Fig. 41) and *C. mesra* (Fig. 89) have very similar armature in their internal sacs. The medial spines of *C. mesra*, however, have hooks at the basal ends and the apical spines are thinner and more U-shaped than those of *C. cyprus*. The large, basal spines in the internal sac of *C. gigas* (Fig. 62) are similar to others in the group but the apical spines are more diffuse. The two pairs of the most apical spines of *C. pallidus* (Fig. 97) are clumped medially and thus are similar to *C. germari* (Fig. 58). But *C. germari* differs in that it has medial, obscure, hook-shaped processes in the in-

ternal sac that are often embedded in a triangular area of small spines that sometimes partially obscures the hook-shaped processes. In addition, the ventral valve of *C. germari* has lateral margins with a broad, sclerotized band.

Members of Subgroup 7, *C. macropterae* (Fig. 85) and *C. nigrosignatus* (Fig. 94), have nine spines in the internal sac. The structure and placement of the spines are very different in the two species. The internal sac of *C. nigrosignatus* has spines as follows: a pair of large, broad spines with slightly curving apices near the base, then immediately apical to these another pair of short, pointed spines with wide bases, then near the middle and apex of the internal sac are other groups of spines consisting of two dome-shaped pointed spines and a third single slender spine immediately apical to these, together with two very small spines. In contrast, the internal sac of *C. macropterae* has large, recurved spines as follows: from the base to the apex of the sac are two series of two spines ventrally and one series of five subapical, evenly spaced spines. These spines are moderately small compared to those of *C. nigrosignatus*. Externally, specimens of *C. nigrosignatus* are consistently smaller in total body size than any other species in the Caryedontini that are known to us, the median carina on the head is absent and the scutellum is minute, with fine silver pubescence.

Subgroup 8 contains only *Caryedon fathalae* because it is the only species in the *Acaciae* group that lacks spines in the internal sac of the male genitalia (Fig. 55). It may be distinguished from some other species in Senegal by its almost black coloration.

Subgroup 9 contains only one species, *C. uganda*, known from females only, but *C. uganda* differs from all other species of *Caryedon* by the unique structure of the female genitalia, as follows: the vaginal area is an elongate tube, with a sclerotized area near the neck of the bursa copulatrix consisting of a centrally placed pair of rods, only slightly more sclerotized than the surrounding area. At each of the extreme lateral margins is another rod-like structure with spiral ornamentation, the neck of the bursa copulatrix is short and slightly constricted; and the bursa copulatrix has two small areas of spines near the neck (Fig. 107). Of possible significance is that the elytra do not have maculations on the integument or pubescence or at most have indefinite darker lines on the thorax or elytra.

Caryedon akdamaricus Decelle & Lodos,
nomen nudum

Caryedon akdamaricus Decelle & Lodos 1979a: 328.
Nomen nudum.

Decelle & Lodos (1989: 167) referred to *Caryedon akdamaricus* Decelle (1989) as being from Van (islet of Akdamar), Turkey. Specimens they cited were taken on umbelliferous flowers. No description was given, and to our knowledge, this name was never published. It is therefore a *nomen nudum* and not available.

***Caryedon albonotatus* (Pic)**

Figs. 28, 147

Caryoborus albonotatus Pic 1898b: 371 (Syntypes: Natal; MNHN).

Pachymerus albonotatus: Pic 1913: 7, 1921: 13, 1935: 12; Zacher 1952: 469.

Caryedon albonotatus: Van Tonder 1985: 146.

C. albonotatus: Prevelt 1965: 530, 1966: 10, 1967a: 3, 1971: 258; Center & Johnson 1974: 1101; Southgate 1979: 458; Pfaffenberger 1985: 1; Udayagiri & Wadhi 1989: 228; Ernst *et al.* 1990: 178; Borowiec 1990a: 374; Delobel *et al.* 1995b: 81; Silvain & Delobel 1998: 534.

Description.—*General facies*: Integument fuscous to fusco-piceous, overlaid with a greatly varying pattern of setae, predominantly white on thorax and with large white sutural patch. Length 4.5–6.2 mm. Width 2.5–3.3 mm.

Head: Integument fuscous, thickly overlaid with mixture of white and golden pubescence; median carina prominent between widely spaced eyes; eyes prominent and inset on dorsal, apical edge by a strongly produced eyebrow ridge which extends over the point from which antenna arises; antennal segments 5–11 serrate, apical segment short and evenly acuminate, segment 1 nearly twice as long as segment 2; segments 1–4 testaceous with some darker areas on segments 1 and 5–11; usually alternately testaceous or dark, but with considerable variation.

Pronotum: Subquadrate, with lateral margins straight for basal 0.66 and conical for apical 0.33, basal line hardly produced medially; integument fuscous with varying amounts of fusco-piceous coloration; surface covered with large irregular punctures, overlaid with mixture of white, golden and black setae; usually with a small longitudinal bare area medially placed near basal edge and at right angles to it.

Scutellum: As broad as long and covered by white setae.

Meso- and Metathorax: Elytra longer than broad, rounded apically, area covered by interstices 3–5 raised at base into a slight hump, thus stria 6 ends basally in a depression between edge of this area and humeral callosity; integument composed of mixed areas of fuscous and fusco-piceous with a predominant piceous area in basal region, followed by a large V-shaped area of fuscous integument extending apically and narrowing along sutural line (Prevelt (1965) found considerable variation in the elytral pattern, some of which he included in figures); lateral margins and apical 0.33 of elytra liberally marked with black; pubescence of maculation of mixed black, golden and white setae, setae on the apical end of interstices 3–6 raised to form a ridge and a slight depression at extreme apex; legs with integument basically fuscous with maculations on femora and tibia, pubescence on legs similar to that on remainder of insect; prepectenar ridge of hind femur serrate.

Pygidium: Lateral margins slightly arcuate in both sexes and with apical end truncated; male with apical edge almost straight except for a very slight medial depression, female with a well defined medial notch in apical edge and a rounded median tubercle before apical margin; integument of mixed fuscous and piceous areas overlaid with mixed pubescence of white and brown setae.

Male genitalia: (Figs. 28, 147). Median lobe short, broad; ventral valve with lateral margins convex, gradually narrowing to acuminate apex; dorsal valve narrower, lateral margins slightly concave, narrowing to rounded apex; armature of internal sac with 4 spines arranged as follows: internal sac armed near base with two long, slightly curving spines with slightly spatulate bases, flanked by a pair of shorter, thicker, straight spines (Figs. 28, 147); lateral lobes narrow, elongate, very rounded with slight medial cleft at their rounded apices, apices covered with elongate setae (Fig. 147).

Female genitalia: Unknown.

Host Plants.—*Old records*: *Acacia erioloba* (as *A. giraffae*; Zacher 1952: 471); *A. nilotica* (Prevelt 1965: 531, 1967a: 5; Udayagiri & Wadhi 1989: 228); as *A. arabica*; Udayagiri & Wadhi 1989: 228); *A. n. subsp. adstringens* (as *A. n. adansonii* (Guill. & Perr.) Brenan; Delobel *et al.* 1985: 81); *A. sieberiana* (Udayagiri & Wadhi 1989: 228; Delobel *et al.* 1995:

81; Prevett 1965: 531, 1967a: 5); *A. tortilis* (Udayagiri & Wadhi 1989: 228).

New records: None.

Distribution.—Natal, West, East, Central and Southern Africa, with an isolated record from Ethiopia (Southgate, unpublished). Nigeria (Prevett 1965: 530). Senegal (Delobel *et al.* 1995b: 81). South Africa (Van Tonder 1985: 146).

Discussion.—*Caryedon albonotatus* is in the *Interstinctus* Group. See discussion of *C. interstinctus* for a discussion of this species. Because Pic did not designate a holotype of *C. albonotatus* in his original description and there was more than one specimen, the types are syntypes. There is a syntype in the Pic Collection in the MNHN (Southgate, unpublished). *Caryedon albonotatus* var. *diversicolor* (Pic)

Pachymerus albonotatus var. *diversicolor* Pic, 1921: 13 (Afrique orientale anglaise: Tana River).

Caryedon albonotatus var. *diversicolor*: Udayagiri & Wadhi, 1989: 228.

BJS made a thorough search of the Pic collection in Paris but failed to find the type of this subspecies, although he found *Caryedon albonotatus* var. *multinotatus*, the other "variety" of *C. albonotatus* described by Pic. Therefore, the placement of *C. a. diversicolor* may never be accomplished unless the type is found.

***Caryedon albonotatus* var. *diversicolor* (Pic)**

Pachymerus albonotatus var. *diversicolor* Pic 1921: 13 (Afrique orientale anglaise: Tana River).

Caryedon albonotatus var. *diversicolor*: Udayagiri & Wadhi 1989: 228.

BJS made a thorough search of the Pic collection in Paris but failed to find the type of this subspecies, although he found *Caryedon albonotatus* var. *multinotatus*, the other variety of *C. albonotatus* described by Pic. Therefore, we have not been able to ascertain the identity of *C. a. diversicolor* with certainty.

***Caryedon alluaudi* (Allard)**

Figs. 29, 145, 162

Caryoborus alluaudi Allard 1895a: CLIV (Holotype ♂: N Madagascar; MNHN).

Pachymerus alluaudi: Pic 1913: 7.

P. allaudi: Udayagiri & Wadhi 1989: 242. Incorrect subsequent spelling.

Caryedon alluaudi: Decelle 1965: 223; Borowiec 1990a: 375, 1990b: 60.

Description.—*General facies:* Integument fusco-piceous or piceous sparsely covered with silver and golden pubescence; pubescence on elytra thicker on alternate interstices given a longitudinal, striped effect. Length 4.5–6.0 mm. Width 2.1–2.5 mm.

Head: Integument fusco-piceous to piceous; surface reticulate; median carina very prominent; overlying pubescence very sparse varying to almost non-existent; a few long, golden, upstanding setae present on head immediately behind eyes; distance between eyes narrow, equal to length of antennal segment 2; antennae varying from testaceous to dark testaceous, segment 1 three times as long as segment 2, usually slightly darker; segments 5–10 subserrate in male and slightly more serrate in female; each segment 1.5 times longer than wide, segment 11 almost evenly acuminate.

Pronotum: Subquadrate, basal half of lateral margins straight, conical but not acutely so for apical 0.5; female with slight tendency for basal 0.5 to be slightly concave; with integument fusco-piceous with some specimens (mostly males) fuscous, surface covered with large shallow irregularly spaced punctures in male, deeper and larger in diameter in female; overlying pubescence very fine, recumbent silver setae in male, with sparsely situated upstanding golden setae, female with slightly coarser silver setae and in addition three longitudinal bands of golden to black setae giving faint striped effect.

Scutellum: Longer than broad, narrowing toward apex, covered with white setae.

Meso- and Metathorax: Elytra longer than broad; integument fuscous to piceous, if mostly fuscous then with piceous areas along basal end of lateral margin; pubescence silver with greater amount of pubescence on interstices 3, 5, 7 and 9 giving appearance of stripes, a number of upstanding golden hairs arise at intervals among otherwise recumbent setae; legs testaceous to fuscous, hind femora slightly darker than legs 1 and 2; prepectenar ridge of hind femur serrate, pecten with large first spine followed by 10–13 smaller spines about 0.5 as long as first spine.

Pygidium: Male with lateral margins slightly arcuate, slightly truncate at apex, integument fuscous to fusco-piceous with golden pubescence and with a median line of white pubescence extending for length of pygidium; female with lateral margins almost straight, longer than broad with apex rounded, integument fusco-piceous, surface less densely covered with golden setae,

without median white line, some examples with median tubercle near apical border.

Male genitalia: (Fig. 29). Median lobe short, broad, ventral valve lightly sclerotized, lateral margins convex, gradually narrowing to acuminate apex; dorsal valve narrower, lateral margins convex, gradually narrowing to acuminate apex; armature of internal sac without spines, lined with small spinules, spinules smaller near base of internal sac but larger and more concentrated medially (Fig. 29); lateral lobes with triangulate edges that are more heavily sclerotized than remainder of lateral lobes, apices with slight medial cleft, curved toward midline of median lobe, with many large, moderately long setae.

Female genitalia: (Fig. 162). Vaginal sclerites extremely thin, at most ornamented with a small area of fine spines, together with an extremely wide neck which has a line of curiously shaped structures at point of constriction of neck before it reaches bursa copulatrix; bursa copulatrix appears unornamented but varies to pale brown in color which suggests that it might be somewhat sclerotized, which is extremely unusual; spiculum ventrale also unusual because 2 outer shoulders of main arms with pointed protuberances that continue to lesser degree along outside edge to apex. We know of no other species that has this form of ornamentation.

Host Plants.—Unknown.

Distribution.—Northern Madagascar. Madagascar (Borowiec 1990a: 375, 1990b: 60; BJS).

Discussion.—*Caryedon alluaudi* is in the *Alluaudi* Group. Southgate (unpublished) defined the *Alluaudi* Group as having "elytra with pubescence of alternate interstices thicker giving the appearance of longitudinal stripes" (Fig. 145). Only *Caryedon alluaudi* and *C. beniowskii* have elytral pubescence arranged in this manner and thus are distinct from the remainder of *Caryedon*. The longitudinally white striped elytra ally *C. beniowskii* to *C. alluaudi* but *C. beniowskii* differs in that it has a narrower body, shorter apical antennal segments, and the male genitalia are quite different. *Caryedon beniowskii* has six pairs of large sclerites in the internal sac of the male genitalia (Fig. 34) while the internal sac of *C. alluaudi* sac has no large sclerites (Fig. 29).

So far as can be ascertained, *C. alluaudi* is confined to Madagascar. There are no records as yet from the African mainland nor have any host plants been recorded for this species.

BJS examined a paratype of *C. alluaudi* from the Pic collection (MNHN) and material from the Institut de Recherche Scientifique à Madagascar with the following data: Ambodimanga, Majunga, (1 specimen); Ampijoroa 179 m, Ankarafantsika I-57, (7 specimens); Andibo 190 m, II-57, (4 specimens); Beloba III-56., (5 specimens); Beloha II-4-56, (4 specimens); Berazaba 11-I-50, (1 specimen); Maroantsetra, Ambodivoangy, (8 specimens); Morondava I-56. (6 specimens); Nosy, Pointe à la Fièvre, (1 specimen); Station Agric., Bas Mangoky, (1 specimen).

The elytral pubescence arranged to give the appearance of longitudinal stripes on the elytra of these two species of *Caryedon* is similar to *Afroredon martini*, but they do not have any of the other characteristics of *Afroredon*. It is interesting that all three species with longitudinal stripes are from Madagascar.

***Caryedon amplipennis* (Fairmaire), new combination**

Figs. 30, 142, 148

Bruchus amplipennis Fairmaire 1902: 245 (Holotype ♀, Plateau de l'Ankara, Hukara, Madagascar; MNHN).

Pachymerus amplipennis: Pic 1913: 7; Udayagiri & Wadhi 1989: 242.

Description.—**General facies:** Integument fuscous overlaid with adpressed pale fawn and golden setae interspersed with patches of darker brown setae giving a mottled effect. Length 4.1–7.0 mm. Width 2.0–3.5 mm.

Head: Broad, prominent carinae extending for 0.66 distance from base of clypeus to base of head; eyes coarsely faceted and slightly emarginate at point of insertion of antenna; integument dark fuscous, sparsely covered with mixture of light fawn and golden hairs, antenna serrate, segment 1 twice as long as segment 2, segments 1–4 rounded, becoming slightly swollen towards their apices, basal 0.5 of segments fuscous, apical 0.5 darker; segments 5–10 slightly less than twice as long as broad, each segment varying in its degree of dark fuscous area, segment 11 unevenly acuminate.

Pronotum: Transverse, basal 0.66 of lateral margins slightly arcuate, apical 0.33 strongly conical; basal edge strongly produced medially; integument dark fuscous with some lighter areas, surface covered with large ovoid to round punctures irregularly spaced; pubescence thickly covering

integument almost completely obscuring it, composed of a golden longitudinal band in center of thorax with long pale setae on either side.

Scutellum: Longer than broad, completely covered by long, fawn pubescence.

Meso- and Metathorax: Elytra together, longer than broad, tapering somewhat strongly toward rounded apices; integument fusco-piceous, striate, striae formed by large oval disconnected punctures; adpressed pubescence composed of pale-fawn, gold and brown giving a mottled effect, predominance of light pubescence along sutural line and lateral margins; legs with mottled integument of light and dark fuscous areas overlaid with mottled pubescence; hind femur with prepectenar ridge composed of about 3 small spinules, pecten composed of one large, acuminate spine near middle followed by about 9 blunt spines about 0.5 as long as large spine.

Pygidium: Broad, lateral margins arcuate; integument fuscous, punctate, overlaid with predominantly golden and dark brown pubescence in male, female with a greater proportion of pale pubescence.

Male genitalia: Unknown.

Female genitalia: (Figs. 30, 148). Vaginal sclerites very thinly sclerotized and contained within a heart shaped area, the plates are two oval discs with no thickening of cuticle, they lead straight to bursa copulatrix without a neck and this has ornamentation; the oviposition lobes differ from the usual shape in that they end basally in a T-shaped structure; spiculum ventrale broadly arcuate with thickened areas at extremities of shoulders leading to a narrow, triangular, acuminate medial extension.

Host Plants.—Unknown.

Distribution.—Madagascar. Hukara; Beloha III-56, A. R.; Station Agric. Bas- Mangoky; Ambovombe, Amboasary II-56. A. R.

Discussion.—*Caryedon amplipennis* is the only species in the *Amplipennis* Group. BJS believed it to be unique and to form a distinct group of *Caryedon*. BJS distinguished it from other *Caryedon* because it has a very distinctive appearance formed by the possession of adpressed hairs on the elytra and the large unconnected punctures that form the striae (Fig. 142). With these characteristics, it forms a connecting link between the markedly individual species in the *Interstinctus* Group and the remaining species of the genus *Caryedon*. With the former, it has in common the

thickly deposited pubescence of widely varying colors together with a relatively large size. Apart from this, it resembles the remaining species that have maculate elytra in varying degrees.

Caryedon arenarum Decelle

Figs. 31, 32

Caryedon arenarum Decelle 1979b: 84 (Holotype ♂: dunes entre Obbia et Durgale, Somalia; MZLS); Udayagiri & Wadhi 1989: 228.

Description.—This description is translated and paraphrased from Decelle (1979b). *General facies*: Quite similar to *C. acaciae*, of uniform reddish mahogany coloration, without darker maculations. It differs externally from *C. acaciae* in its transverse appearance, back of vertex being less deep, and by its pronotum less than 1.5 times wider than long, while in *C. acaciae* it is 1.5 times wider than long. The lateral margins of the pronotum of *C. arenarum* are also shorter from base to apex, first it is subrectilinear, then in a pronounced curve (Fig. 31) while in *C. acaciae*, these lateral margins are subparallel, longer, and are slightly recurved to the exterior before the posterior angles; punctuation of the pronotum of *C. arenarum* very dense. Length 3.3 mm (3.8 mm with head and pygidium).

Meso- and Metathorax: Elytra short, three times longer than pronotum, in *C. acaciae* they are nearly 3.5 times longer than pronotum, length of elytra 1.5 times wider than width of elytra together; at base, stria 5 beginning slightly behind stria 6, these two striae almost touching at their bases while in *C. acaciae* these striae are equal at their bases and are well separated; hind femur with pecten formed of a slightly stronger spine followed by seven smaller spines.

Male genitalia: (Fig. 32). Median lobe slightly elongate, moderately broad; ventral valve narrow, lateral margins concave, apex acuminate, dorsal valve narrower than ventral valve, lateral margins convex gradually curved to an acuminate apex, heart-shaped; armature of internal sac with 8 spines arranged as follows: with many small spinules at base, two strong, curved spines slightly more apical, pair of much smaller spines lateral to bases of large spines; near middle two elongate spines with enlarged bases, separated near their bases by patch of fine spinules; two thin, J-shaped spines at apex.

Female genitalia: Unknown.

Host Plants.—Unknown.

Distribution.—Somalia.

Discussion.—*Caryedon arenarum* is in the *Acaciae* Group. See *C. acaciae* for a discussion of this species and other members of Subgroup 5.

Caryedon arenarum is quite similar to *C. acaciae* because of its uniform reddish mahogany coloration, without darker maculations. It differs externally in its transverse appearance, back of the vertex being less deep, and by its pronotum less than 1.5 times wider than long, while in *C. acaciae* it is 1.5 times wider than long. In *C. arenarum* the lateral margins of its pronotum are shorter from base to apex, first subrectilinear, then in a pronounced curve (Fig. 31) while in *C. acaciae* these lateral margins remain subparallel, longer, and are slightly recurved to the exterior before the posterior angles. The punctation of the pronotum of *C. arenarum* is very dense. The male genitalia of the two species are distinctly different (Figs. 24, 32 and see above).

Apparently Jean Decelle was impressed with the sand in the "dunes entre Obbia et Durgale" when he named this species with the specific epithet *arenarum*, a noun (arena L., sand) of the first declension in the feminine, genitive plural.

***Caryedon atrohumeralis* Prevelt**

Figs. 33, 149

Caryedon atrohumerale Prevelt 1965: 538 (Holotype ♂: Bauchi Province, near Giade, Nigeria; BMNH); Prevelt 1966: 13, 1967a: 5, 1971: 258; Pfaffenberger 1985: 1; Udayagiri & Wadhi 1989: 228; Borowiec 1990a: 375; Delobel *et al.* 1995b: 81.

Description.—*General facies*: Integument mainly fuscous with variable maculate areas on thorax and elytra, pubescence mainly pale fawn with dark pubescence over dark integument. Length 2.9–6.2 mm. Width 2.1–3.6 mm.

Head: Testaceous to fuscous, median carina prominent at base becoming glabrous at apex; width between eyes equal to length of antennal segment 2; surface reticulate; pubescence silver or golden setae; eyes coarsely faceted; antenna serrate; segment 1 twice as long as broad, antenna testaceous with slight darkening on segment 1.

Pronotum: Transverse, lateral margins with basal 0.66 straight, apical 0.33 conical, integument fuscous with piceous lateral borders and four

piceous areas arising as two short longitudinal lines from the apical margin and two piceous patches on the basal margin, surface covered with large unevenly spaced punctures, pubescence silver to golden with silver over piceous integument.

Scutellum: Longer than broad with white or golden pubescence.

Meso- and Metathorax: Elytra together longer than broad with apices rounded; integument fuscous on central and apical areas, lateral area from humerus to apical 0.33 black, extending medially for up to four stria intervals, broad black band across apical 0.33; pubescence golden over fuscous integument, silver and black mixed over lateral black areas and mostly black setae over black lateral band; legs 1 and 2 testaceous, hind femur with darker color of elytron and abdomen, with varying amount of maculation corresponding to color of rest of elytron and abdomen; prepectal ridge of hind femur with small, almost indistinguishable serrations.

Pygidium: Similar in shape in both sexes; male as long as broad, female slightly longer with more truncated and narrow apex; integument testaceous to fuscous, extreme examples with majority of integument dark fuscous; pubescence golden or whitish-silver setae.

Male genitalia: (Fig. 33). Median lobe short and broad, ventral valve with lateral margins concave, gradually narrowing to a blunt apex; dorsal valve larger, lateral margins sinuate, gradually narrowing to blunt apex; armature of internal sac with 10 spines arranged as follows: base of sac with two pairs of spines, one pair larger and longer, both pairs slightly curved with broadened bases, four smaller, curved spines near middle, and near apex another pair of fairly long, slightly curved, very lightly sclerotized spines; lateral lobes narrow, expanded at apices, slight cleft at apex, large number of setae on apices.

Female genitalia: (Fig. 149). Vaginal sclerites similar to *C. immaculatus* but broader, each plate bears an oval area from which a large number of striations radiate, mostly towards lateral margins; small tubular structure posterior to this area and leading in from the center, that is fairly strongly sclerotized, and opens out to spatulate base; apical end of neck of bursa copulatrix with a number of long, thin spines, these extend down one side, remaining area covered with minute spines except for band of stout spines which occur about

mid-way along neck; bursa copulatrix appears unarmed.

Host Plants.—*Old records:* *Combretum hypopilinum* Diels (Udayagiri & Wadhi 1989: 228; Prevett 1965: 540, 1967a: 5); *C. lamprocarpum* Diels (Udayagiri & Wadhi 1989: 228; Prevett 1965: 540, 1967a: 5).

New records: None.

Distribution.—Nigeria. Zambia (Borowiec 1990a: 375). Senegal (Delobel *et al.* 1995b: 81).

Discussion.—*Caryedon atrohumeralis* is in the *Longipennis* Group. See discussion of *C. longipennis* for a discussion of this species.

Prevett recorded this species from seeds of *Combretum hypopilinum* and *C. lamprocarpum* and collected the species over a wide area of northern Nigeria.

Caryedon beniowskii Borowiec

Fig. 34

Caryedon beniowskii Borowiec 1990a: 375 (Holotype ♂: Madagascar, Mont d'Ambre, Hammerstein S; PAN).

Description.—Paraphrased from Borowiec (1990a). *General facies:* Color uniformly yellowish-red. The longitudinal white stripes on the elytra of this species ally it with *C. alluaudi* but it has a narrower body, shorter apical antennal segments, and the male genitalia have six pairs of large sclerites in the internal sac whereas in *C. alluaudi* the internal sac has no large sclerites. Length (pronotum—elytra): 3.9 mm. Width: 2.0 mm.

Vestiture: Uniform, whitish, sparse, not covering body surface, elytral rows not pubescent or with very short and sparse hair, so elytra are longitudinally white striped.

Head: Short, distance from base of antenna to apex of labrum about 0.33 distance from upper limits of eyes to apex of labrum; frons narrow with sharp median carina, in narrowest part about as wide as two eye facets together, ocular sinus about 0.1 times as long as eye; tempora as wide as ocular facet diameter; antennal segments 1–4 filiform, 2 shorter than any other segment, 5–10 about twice longer than wide, 11 about 2.4 times longer than wide; antenna reaching to 0.33 of elytral length.

Pronotum: Pentagonal, lateral margins slightly converging anterad, disc slightly convex, without impressions, moderately densely punctured; distance between punctures usually equal to puncture

diameter or slightly smaller, space between punctures with small secondary punctuation; lateral prothoracic carina extending from base to 0.6 distance to anterior edge of pronotum; prosternum separating procoxae for about 0.3 their length.

Scutellum: Small, rounded apically.

Meso- and Metathorax: Elytron 3.25 times longer than wide; striae moderately impressed, indistinctly punctate, intervals smooth, striae 4 and 5 shortened posterad; hind coxa smooth; hind femur about twice longer than wide, prepecten ridge slightly serrate, first spine of pecten about twice longer than second, remaining 10 spines gradually smaller; hind tibia strongly arcuate with complete set of sharp carinae, mucro about as long as width of tibial apex.

Abdomen: Unmodified, last sternum not emarginate, pygidium moderately convex in lateral view.

Male genitalia: (Fig. 34). Median lobe short and broad; ventral valve broad, short with lateral margins deeply concave, with short, narrow, medial acuminate apex, dorsal valve narrow, with lateral margins convex, narrowing to acuminate apex; armature of internal sac with 12 sclerites arranged as follows: with six pairs of large sclerites, first pair and second pairs near base, first pair very large, hook-like, second small, at base of first pair; near middle 0.33 curved pair, about 0.5 as large as first pair; three pairs near apex, one pair large, elongate with other two pairs smaller, about same size and medial to this pair, one medial pair horn-like, the other arched (Fig. 34).

Female: Unknown.

Host plants.—Unknown.

Distribution.—Mont. d'Ambre, Madagascar.

Discussion.—*Caryedon beniowskii* is in the *Alluaudi* Group. See *C. alluaudi* for a discussion of this species.

Caryedon brevelineatus (Pic), new combination

Pachymerus brevelineatus Pic 1950b: 4 (Madagascar: Diego-Suarez); Udayagiri & Wadhi 1989: 243.

The type of this species is apparently lost although it was described a short time before Pic died in 1951. The description of the species is insufficient to enable certain identification to be made. Pic (1950b) indicated that *C. brevelineatus* was near *C. minutus*, but the only reliable clue

given by Pic is his mention of the marking of the alternate interstices of the elytra with longer white pubescence. The only species known to us with this form of pubescence are *Caryedon alluaudi*, *C. beniowskii*, and *Afroredon martini*, all recorded from Madagascar. The Bruchidae of Madagascar are very poorly known and with further research the species might easily be rediscovered. At this juncture, we cannot recognize this species with certainty.

***Caryedon calderoni* Johnson, Southgate & Delobel,
new species**

Fig. 35

Description.—*General facies:* Integument fusco-testaceous, without maculations; hairs sparse, of fine to coarse, golden pubescence. Length 3.8–4.7 mm. Width 1.8–2.5 mm.

Head: With a thin median carina; integument fusco-testaceous overlaid with fine pubescence; eyes with coarse facets, distance between eyes equal to length of antennal segment 2; antennal segments 1–4 rounded, segments 5–10 serrate, each segment longer than broad, apical segment long with apex slightly acuminate.

Pronotum: Transverse with basal 0.66 of lateral margins slightly arcuate, apical 0.33 acutely conical; integument fusco-testaceous, surface with large shallow punctures, overlaid with fine to coarse, golden setae.

Scutellum: Longer than broad, covered with long whitish pubescence.

Meso- and Metathorax: Elytra together longer than broad, apices rounded; integument fusco-testaceous overlaid with coarse, pale golden pubescence; legs 1 and 2 fusco-testaceous, hind pair fusco-rufous; prepectenar ridge of hind femur with few small serrations, pecten serrate.

Pygidium: In male as broad as long, lateral margins straight, apex truncated; integument fusco-testaceous with coarse, pale golden setae; female slightly more elongate.

Male genitalia: (Fig. 35). Median lobe slightly elongate, narrow; ventral valve with lateral margins convex narrowing to acuminate apex, dorsal valve wide, lateral margins convex, narrowing to acuminate apex; armature of internal sac with large medial plate with two spine-like processes arranged as follows: internal sac armed with fine spicules, a large medial plate with two spine-like processes arising from basal end, apex of each

process obliquely acuminate on either side and surrounded in basal 0.5 by two granulate plates, apical to plate a mass of short, stout spines; area surrounding entrance to ejaculatory duct lined with large, strong, sharply pointed spines (Fig. 35); lateral lobes strongly sclerotized for length of each side and around apical rim, with slight median cleft, apical rim of lobes with many elongate setae.

Female genitalia: Unknown.

Type series.—Holotype ♂ and one paratype, BECHUANALAND: Francistown, ?—1964, G. E. J. Morley, ex seed of *Combretum*. Holotype and paratype deposited in the BMNH.

Host Plants.—*Combretum* sp.

Distribution.—Botswana (Bechuanaland became Botswana in 1966).

Etymology.—We have pleasure in naming this species in honor of Dr. M. Calderon of Tel Aviv, Israel who has contributed significantly to the knowledge of the Bruchidae of the Middle East.

Discussion.—*Caryedon calderoni* is in the *Acaciae* Group, subgroup 2. See *A. acaciae* for a diagnosis and discussion of this species. The plate in the internal sac is diagnostic for this species.

***Caryedon cassiae* (Gyllenhal)**

Figs. 36, 37, 140

Bruchus cassiae Gyllenhal in Schoenherr 1833: 95 (Holotype: Sierra Leona Africae; NRS).

Pachymerus cassiae: Pic 1913: 7.

Caryedon cassiae: Zacher 1952: 469; Southgate & Pope 1957: 670; Lukianovich & Ter-Minasian 1957: 35; Davey 1958: 386; Prevett 1965: 528, 1966: 10, 1967a: 5; de Luca 1980: 42; Pfaffenberger 1985: 1; Rasplus 1988: 64; Udayagiri & Wadhi 1989: 228; Borowiec 1990a: 378; Gillon *et al.* 1992: 421.

Caryoborus minutus Pic 1902a: 146 (Holotype: Madagascar; MNHN); Borowiec 1990a: 378.

Pachymerus minutus: Pic 1913: 8; Udayagiri & Wadhi 1989: 244.

Caryedon minutus: Borowiec 1990b: 60.

Description.—*General facies:* Integument reddish testaceous to fusco-testaceous, overlaid with fine golden to silver pubescence, without maculations on elytra. Length 5.8–7.0 mm. Width 2.9–3.5 mm.

Head: Fuscous to fusco-testaceous; with sparse silver setae; median carina present, more prominent apically, surface on either side of carina confusedly punctate, punctures of irregular size;

width between eyes varying from 0.5 length to slightly more than length of antennal segment 2, surface covered with fine golden pubescence; eyes prominent with large facets; head strongly constricted at base of eyes, punctures less evident; antennal segments 1–4 rounded, testaceous, segments 5–11 serrate to subserrate, piceous.

Pronotum: Transverse, integument fuscous to fusco-testaceous, lateral margins with basal 0.66 straight or at most slightly arcuate, apical 0.33 acutely conical; surface punctate; overlaid with fine silver to golden setae, integument clearly visible through setae.

Scutellum: Slightly longer than broad, acuminate, covered with long white pubescence.

Meso- and Metathorax: Elytra 0.33 to 0.5 longer than broad, apices rounded, striate, striae with deep well-defined punctures; integument fusco-testaceous to fusco-piceous, lighter examples with apical area of elytra darker; pubescence of very fine silver or golden setae, integument clearly visible through setae; legs 1 and 2 testaceous, hind leg fusco-testaceous to fusco-piceous; hind femur with prepectenar ridge varying from smooth to several small denticles present.

Pygidium: Longer than broad, male with broadly rounded apex and lateral margins slightly arcuate, female slightly more pointed at apex with lateral margins less arcuate; surface of male pygidium more or less flat except extreme apex curved under, female flat at extreme apex but with slight medial hump about 0.33 length from apex in longitudinal axis; integument overall fusco-testaceous in males (with some slight variation), covered with long golden pubescence, females with dark central area reaching almost to apex, covered with long silver to golden pubescence.

Male genitalia: (Fig. 36). Median lobe short and broad; ventral valve broad at base, elongate, very narrow because lateral margins deeply concave, apex acuminate, dorsal valve with lateral margins convex, gently curving to acuminate apex; armature of internal sac with 12 spines arranged as follows: group of spines extending from base to middle, from base group consists of two largest curved spines broadened at their base with two much smaller spines near base of large spines, followed by pair of curved spines, two pairs of straight spines and one pair of curved spines apically, spines arranged in succession apically from large spines; entrance to ejaculatory duct campan-

ulate, covered with small spines, behind this an area, separated from main pair covered with small spines (Fig. 36); lateral lobes narrow with broad apices, with slight medial cleft, lobes spatulate with many elongate setae at apices.

Female genitalia: (Fig. 37). With well-developed vaginal sclerites consisting of two main circular areas strongly sclerotized around periphery, flanked on either side by other sclerotized areas, basally two elongated areas of thinly sclerotized plates which become gradually narrower towards neck of bursa copulatrix; bursa copulatrix covered with small spines particularly at end nearest neck.

Host Plants.—*Old Records*: *Cassius* sp. (Gyllenhal in Schoenherr 1833: 95); *Cassia arereh* (Prevett 1965: 529, 1967a: 5; Udayagiri & Wadhi 1989: 228); *C. javanica* subsp. *nodosa* (as *C. nodosa* Buch.-Ham. ex Roxb.; Udayagiri & Wadhi 1989: 228); *C. sieberiana* (Prevett 1965: 529, 1967a: 5; Udayagiri & Wadhi 1989: 228). *C. surattensis* (Rasplus 1988: 64). *Senna alata* (as *Cassia alata*; Rasplus 1988: 64); *S. hirsuta* (as *Cassia hirsuta* L.; Rasplus 1988: 64); *S. obtusifolia* (as *Cassia obtusifolia* L.; Rasplus 1988: 64); *S. occidentalis* (as *Cassia occidentalis*; Rasplus 1988: 64); *S. podocarpa* (as *Cassia podocarpa* Guill. & Perr.; Rasplus 1988: 64). *Acacia nilotica* (as *A. arabica*; Peake 1952: 318, Udayagiri & Wadhi 1989: 228). *Arachis hypogaea* (Davey 1958: 388, Lukianovich & Ter-Minasian 1957: 35, Zacher 1952: 474). *Bauhinia rufescens* (Prevett 1965: 529, 1967a: 5). *Cajanus* sp. (Udayagiri & Wadhi 1989: 228). *Delonix regia* (as *Poinciana regia* Bojer ex Hook; Zacher 1952: 472). *Prosopis africana* (Prevett 1965: 529, 1967a: 5; Udayagiri & Wadhi 1989: 228). *Rhamnus purshiana* (as *Rhamnus purshiana*; Zacher 1952: 477) (Rhamnaceae). *Terminalia* sp. (Udayagiri & Wadhi 1989: 228) (Combretaceae).

New Records: *Cassia javanica*: Agric. Dept., S. Leone, Feb. 58.

Distribution.—Sierra Leone. Madagascar. Nigeria (Prevett 1965: 529). Ivory Coast (Rasplus 1988: 64). Guinea, Sudan, Ethiopia, Kenya, Tanzania, Zambia, Madagascar (Borowiec 1990a: 386). Zaïre (now Democratic Republic of the Congo; Udayagiri & Wadhi 1989: 228).

Discussion.—*Caryedon cassiae* is in the *Acaciae* Group. See *C. acaciae* for a discussion of this species and other members of Subgroup 5.

Caryedon kivuensis, *C. cassiae*, *C. crampeli*, and *C. congensis* are all closely related. Delobel and Johnson studied the male genitalia of all four species

and found them to be distinctly different, distinct enough to merit species status for the four.

Caryedon cassiae is a widespread species that, unfortunately, has been misidentified many times and has been placed in several genera. The original locality of this species is given as Sierra Leone. Examination of the type, as labeled by persons unknown in the Stockholm Museum, revealed that this specimen is not conspecific with the other material in the type series. BJS could not, however, find any disagreement between the specimen labeled as holotype and the description given by Gyllenhal. The specimens that make up the paratypes, three in all, consist of another species. An examination of the genitalia of the paratypes convinced BJS that they are conspecific with *Caryedon pallidus*. As would be expected with a species with a widespread distribution, the morphology varies somewhat.

Caryedon cassiae has a wide distribution (see Distribution above) and in consequence has been described as other species from widely separated localities, e.g., Borowiec (1990a) synonymized *C. minutus* with *C. cassiae*.

Caryedon conformis (Fåhraeus)

Fig. 38

Bruchus (subgen. *Caryoborus* Sch.) *conformis* Fåhraeus 1871: 450 (Holotype ♀: 'Caffraria'; NRS).

Pachymerus conformis Pic 1913: 7.

Caryedon conformis: Decelle 1958: 83, 1960a: 73; Prevett 1965: 532, 1966: 13, 1967a: 5, 1968: 247; Pfaffenberger 1985: 1; Udayagiri & Wadhi 1989: 228; Borowiec 1990a: 379; Delobel *et al.* 1995b: 81.

Description.—*General facies*: Integument testaceous to fuscous with variable amounts of maculations; overlying pubescence of pale golden setae. Length 5.8 mm. Width 2.7 mm.

Head: With integument mainly fuscous with some darker areas varying to all testaceous, surface reticulate, median carina vague, usually a glabrous line varying to impressed at base; space between eyes wide, nearly equal to length of antennal segment 1; surface fairly thickly covered with golden pubescence; eyes coarsely faceted; antennal segments 5–10 serrate, segments 1–4 rounded with segment 2 approximately 0.5 length of segment 1, apical segment unevenly acuminate; antenna usually testaceous, some segments darker, particularly near base or entire segment darker.

Pronotum: Subquadrate, lateral margins equally divided with basal 0.5 straight and apical 0.5 conical; surface punctate with unevenly, widely-spaced punctures, integument fuscous to fusco-piceous with varying amounts of black maculations, mostly in form of stripes or a wide longitudinal band covering central area, some specimens have dark areas along apical 0.5 of lateral margins; pubescence either golden or silver over fuscous or piceous integument.

Scutellum: Longer than broad, covered with long, white setae.

Meso- and Metathorax: Elytra longer than broad, apices slightly truncate; integument testaceous to fusco-piceous with variable amounts of maculations; pubescence either all silver or fawn or a mixture of silver or fawn over testaceous integument with brown or black setae over dark integument; legs 1 and 2 testaceous or fuscous, hind pair of same coloration as rest of insect, with a varying amount of maculations; prepectenar ridge of hind femur with well-defined serrations.

Pygidium: Male with lateral margins arcuate and rounded apex; pygidium as broad as long; female with lateral margins very slightly arcuate, with truncated apex, longer than broad; integument varying from all testaceous to completely piceous; pubescence usually dark over dark integument and pale fawn over testaceous to fuscous integument; some specimens with pale median line of pubescence which overlies dark integument.

Male genitalia: (Fig. 38). Median lobe elongate; ventral valve strongly sclerotized, lateral margins concave, narrowing to a moderately broad, truncated apex; dorsal valve broad, with lateral margins slightly convex, narrowing to acuminate apex; armature of internal sac with 5 spines arranged as follows: with a pair of large foot-shaped spines and a pair of slightly curved spines with strongly curved and slightly expanded bases all embedded in a mass of minute spines near base; one thin, straight, short spine apical to these; entrance to ejaculatory duct cone-shaped and as strongly sclerotized as spines (Fig. 38); lateral lobes narrow, elongate, significantly broadened at apices, apices long, rounded, with strongly sclerotized margins and slight medial cleft, moderately long setae at apices.

Female genitalia: Vagina broad and thinly sclerotized with no definite sclerotized areas below, neck of bursa copulatrix consists of a slightly more

strongly sclerotized region, rather angular in appearance and with many fairly strong denticles on lower region which merge into an area of very fine teeth; bursa copulatrix without armature.

Host Plants.—*Old records:* *Combretum lamprocarpum* Diels (Prevett 1965: 533, 1967: 5; Udayagiri & Wadhi 1989: 229).

New records: None.

Distribution.—Caffraria. Belgian Congo (Decelle 1958: 83, 1960a: 73). Nigeria (Prevett 1965: 532, 1966: 13, 1967a: 5, 1968: 247). Zaire (now Democratic Republic of the Congo), Tanzania, South Africa, Zambia (Borowiec 1990a: 379). Senegal (Delobel *et al.* 1995b: 81).

Discussion.—*Caryedon conformis* is in the *Serratius* Group, Subgroup 2. See discussion of *C. serratius* for a discussion of this species.

Caryedon conformis has not been recorded more than once or twice until recently. Prevett has shown that some of the material collected by him in Nigeria is conspecific with this species and therefore it is one of the few members of the genus that is common to both northern and southern Africa. Recent examination of material deposited in the BMNH and of material collected in South Africa has confirmed this. In addition to the published records, Mr. Carcarson (late curator of the Nairobi Museum) sent a number of specimens of this species to BJS for examination. These specimens were collected by the late Father Conrad and labeled Tang Terr. Ukerewe I. by the museum. These data are very speculative as all of Father Conrad's notebooks were destroyed and consequently the data with them. As most of his collecting was carried out in the above area it seems probable that this species also occurs over the whole of central Africa as well as those areas already mentioned.

BJS verified that Conrad's original locality was correct. Material sent by the SANC has shown that this species is widely distributed over southern Africa. Its primary host appears to be species of *Combretum*, both in the north and in South Africa.

Prevett (1965: 532) indicated that he had dissected the holotype female of *C. conformis*.

Caryedon congensis Decelle

Fig. 39

Caryedon congensis Decelle 1951: 189 (Holotype: Congo Belge: km. 345 de Kindu; MRAC); Decelle 1960a:

72, 1960b: 142, 1966: 172; Udayagiri & Wadhi 1989: 229.

Caryedon congense: Delobel 1989: 352, 1995: 214.

Description.—*General facies:* Integument reddish testaceous to fusco-testaceous, overlaid with fine golden to silver pubescence, without maculations on elytra. Length 3.0–7.0 mm. Width 2.9–3.5 mm.

Head: Brown, black in front; with sparse silver setae; median carina present; eye large, black; head strongly constricted at base of eyes; antenna elongate, segment 3 about 1.5 times longer than 2 and 4; segments 1–2 red speckled with black, varying to 2–4 dark brown, black from segment 5 to apex.

Pronotum: Campanulate, integument color dense brown, bisinuate on lateral margins, moderately and densely punctate, covered with fine, dense, grey pubescence.

Scutellum: Slightly longer than broad, acuminate, covered with long white pubescence.

Meso- and Metathorax: Elytra elongate, 4 times longer than pronotum, striate, striae finely punctate; integument color dense brown; covered with fine, uniform pubescence; undersurfaces light brown with fine pubescence; legs brown; pecten of hind femur armed with a strong spine about two times longer than apical 14–17 smaller spines.

Pygidium: Small.

Male genitalia: (Fig. 39). Median lobe short and broad; ventral valve broad, short with lateral margins blunt, with short, narrow, medial acuminate apex, dorsal valve narrow, elongate, with lateral margins convex, narrowing to small, rounded apex; armature of internal sac with 12 spines arranged as follows: group of spines extending from base to middle, from base group consists of two largest curved spines with two smaller, rounded spines each with a curved spine near base of large spines, followed by four pairs of slightly to moderately curved spines of variable length and thickness, all six pairs with bases enlarged, spines arranged in succession apically from large spines; entrance to ejaculatory duct campanulate, covered with small spines, area basal to this covered with small spines (Figs. 39).

Female genitalia: Unknown.

Host Plants.—*Old Records:* *Bauhinia thonningii* (as *Piliostigma thonningii*; Delobel 1989: 352).

New Records: *Bauhinia thonningii* (as *Piliostigma thonningii*); Kenya: Muhaka, Jan. 2002; People's

Republic of Congo: Mouyondzi, June 1983, Kilantari, April 1985.

Distribution.—Zaire (now Democratic Republic of the Congo), Tanzania (Decelle 1951: 189, Udayagiri & Wadhi 1989: 229). Kenya, People's Republic of Congo.

Discussion.—*Caryedon congensis* is in the *Acaciae* Group. See *C. acaciae* for a discussion of this species and other members of Subgroup 5.

Decelle (1951) described *C. congensis* as a new species from the Congo. Decelle (1966) then synonymized *C. congensis* with *C. crampeli*. Delobel and then Johnson studied the male genitalia of specimens of both species and found them to differ significantly (Figs. 39, 40). Thus, they are distinct species.

Caryedon crampeli (Pic)

Fig. 40

Pachymerus crampeli Pic 1924a: 25 (Holotype: Congo Français; MNHN?).

Caryedon crampeli: Decelle 1951: 189, 1958: 83, 1966: 172; Udayagiri & Wadhi 1989: 229; Delobel *et al.* 1995b: 81; Silvain & Delobel 1998: 534; Delobel *et al.* 2000: 65.

Description.—*General facies*: Integument reddish testaceous to fusco-testaceous, overlaid with fine golden to silver pubescence, without maculations on elytra. Length 5.8–7.0 mm. Width 2.9–3.5 mm.

Head: Fuscous to fusco-testaceous; with sparse silver setae; median carina present, more prominent apically, surface on either side of carina confusedly punctate, punctures of irregular size; width between eyes varying from 0.5 length to slightly more than length of antennal segment 2, surface covered with fine golden pubescence; eyes prominent with large facets; head strongly constricted at base of eyes, punctures less evident; antennal segments 1–4 rounded, testaceous, segments 5–11 serrate to subserrate, piceous.

Pronotum: Transverse, integument fuscous to fusco-testaceous, lateral margins with basal 0.66 straight or at most slightly arcuate, apical 0.33 acutely conical; surface punctate; overlaid with fine silver to golden setae, integument clearly visible through setae.

Scutellum: Slightly longer than broad, acuminate, covered with long white pubescence.

Meso- and Metathorax: Elytra 0.33 to 0.5 longer

than broad, apices rounded, striate, striae with deep well-defined punctures; integument fusco-testaceous to fusco-piceous, lighter examples with apical area of elytra darker; pubescence of very fine silver or golden setae, integument clearly visible through setae; legs 1 and 2 testaceous, hind leg fusco-testaceous to fusco-piceous; hind femur with prepectenar ridge varying from smooth to several small denticles present.

Pygidium: Longer than broad, male with broadly rounded apex and lateral margins slightly arcuate, female slightly more pointed at apex with lateral margins less arcuate; surface of male pygidium more or less flat except extreme apex curved under, female flat at extreme apex but with slight medial hump about 0.33 length from apex in longitudinal axis; integument overall fusco-testaceous in males (with some slight variation), covered with long golden pubescence, females with dark central area reaching almost to apex, covered with long silver to golden pubescence.

Male genitalia: (Fig. 40). Median lobe short and broad; ventral valve broad, short with lateral margins blunt, with short, narrow, medial acuminate apex, dorsal valve narrow, elongate, with lateral margins convex, narrowing to small, rounded apex; armature of internal sac with 10 spines arranged as follows: group of spines extending from base to middle, from base group consists of two largest curved spines with two much smaller spines near base of large spines, followed by three pairs of slightly curved spines of variable length, spines arranged in succession apically from large spines; entrance to ejaculatory duct campanulate, covered with small spines, area basal to this covered with small spines (Fig. 40).

Female genitalia: Unknown.

Host Plants.—*Old records*: *Bauhinia rufescens* (Delobel 2000: 63); *B. reticulata* (as *Piliostigma reticulatum* (DC.) Hochst.); *Cassia sieberiana* and *Prosopis africana* (Delobel *et al.* 1995: 81); *Senna alata* (as *Cassia alata*; Udayagiri & Wadhi 1989: 229).

New records: None.

Distribution.—République du Congo, Zaïre (now Democratic Republic of the Congo) (Decelle 1951: 189). Senegal (Delobel *et al.* 1995b: 79, Delobel *et al.* 2000: 65). West Africa (Silvain & Delobel 1998: 534).

Discussion.—*Caryedon crampeli* is in the *Acaciae* Group. See *C. acaciae* for a discussion of this species and other members of Subgroup 5.

Pic (1924a) described *C. crampeli* as a new species from the Congo Français. Decelle (1966) then synonymized *C. crampeli* with *C. congensis*. Delobel and then Johnson studied the male genitalia of specimens of both species and found them to differ significantly (Figs. 39, 40). Our studies revealed that they are distinct species.

***Caryedon cyprus* Johnson, Southgate & Delobel,
new species**

Fig. 41, 42

Description.—*General facies:* Integument fuscous overlaid with fawn pubescence. Length 2.9–3.9 mm. Width 1.6–1.8 mm.

Head: Broad, with median carina scarcely carinate or a glabrous line; space between eyes wide, reticulate to punctuate; eyes smaller than most species, facets also small; pubescence sparse; antenna serrate, segments 1–4 rounded, segment 1 slightly less than twice as long as segment 2, segments 5–10 nearly twice as long as wide; apical segment unevenly acuminate; integument ranges from completely testaceous to very dark fuscous.

Pronotum: Quadrate, basal 0.66 of lateral margins straight except extreme basal angles may be slightly produced, apical 0.33 strongly angled towards apical edge; integument fuscous to fusco-piceous or with margin piceous and disc fuscous; surface irregularly punctate with large punctures, overlaid with sparse fawn pubescence.

Scutellum: Slightly longer than broad, integument dark, overlaid with white pubescence.

Meso- and Metathorax: Elytra together longer than broad, apices rounded, striate, striae deep, with large punctures; fuscous, to fusco-piceous, pubescence of white to golden setae; legs 1 and 2 testaceous, hind pair fuscous to dark fuscous; hind femur with serrations absent or very minute on prepectenar ridge, pecten with first spine scarcely larger than other denticles.

Pygidium: With integument fuscous to fusco-piceous overlaid with long white setae.

Male genitalia: (Fig. 41). Median lobe short and broad; ventral valve with lateral margins deeply concave, narrowing to acuminate apex, dorsal valve narrower, lateral margins slightly concave, with acuminate apex; armature of internal sac with 6 spines arranged as follows: with medial pair of spines with slight hook at apex then broaden gradually toward flattened base, apical to these a pair of thin, sharply pointed spines with

almost spherical bases, then a pair of U-shaped spines, two inner ends needle-like, thickening at base of U, finally becoming sharply acuminate at their opposite ends; entrance to ejaculatory duct campanulate and very lightly sclerotized (Fig. 41); lateral lobes narrow, expanded at apices, apices rounded, slight cleft medially, apices of lobes with long setae, setae considerably shorter near medial cleft.

Female genitalia: (Fig. 42). Of the examples available, the genitalia were in very poor condition and only the spiculum ventrale was found intact; it follows the more usual shape of the *Caryedontini* but with a very long elongate basal end.

Host Plants.—Unknown.

Type series.—Holotype ♀ and one paratype ♀: CYPRUS: Yerasa, 1,200 ft, 2. v. 1947, G. A. Mavromoustakis; 1 paratype ♂: CYPRUS: Paramali Plain, 15. v. 1952; and 1 paratype ♀: CYPRUS: Pera Pedi, 15. vi. 1937, G. A. Mavromoustakis, B. M. 1937–808. Holotype and three paratypes deposited in the BMNH.

Distribution.—Cyprus.

Etymology.—The specific epithet *cyprus* is a noun in apposition to *Caryedon*.

Discussion.—*Caryedon cyprus* is in the *Acaciae* Group. See *C. acaciae* for a discussion of this species and other members of Subgroup 6.

Mr. G. A. Mavromoustakis of Cyprus collected this species on flower heads of an unidentified species of the Apiaceae (Umbelliferae) but no records of its larval host are available. In view of its small size, it could develop in a very small seed. *Caryedon cyprus* is closely related to a new species from Israel, *C. mesra* described below, whose larvae have been reported to feed in seeds of the umbelliferous plant, *Ferula communis*, a plant also recorded from Cyprus.

***Caryedon decellei* Johnson, Southgate & Delobel,
new species**

Fig. 43

Description.—*General facies:* Integument fuscous to fusco-piceous overlaid with predominantly white and black setae. Length 5.0–5.5 mm. Width 2.6–3.0 mm.

Head: Integument fuscous to fusco-piceous overlaid with white setae, median carina present between widely spaced eyes, carina extends beyond apical edge of eyes as a raised line above surrounding area; distance between apical edge

of eyes equal to length of antennal segment 1; eyes with large facets; antenna serrate with segments 1–4 rounded, testaceous, with some dark areas, segment 1 nearly twice as long as segment 2, segments 5–11 alternately testaceous and piceous.

Pronotum: Transverse with lateral margins straight for basal 0.66, apical 0.33 acutely conical, basal line not greatly produced medially; integument fusco-piceous to piceous, surface with large, unevenly spaced punctures, overlaid with an area of black setae variable in width and in its continuity (some examples have no more than a series of black patches), either side of black area flanked with white setae; medially along basal line and at right angles to it is a short longitudinal line, bare of setae.

Scutellum: Longer than broad covered with white setae.

Meso- and Metathorax: Elytra together longer than broad; integument composed of mixed fuscous and piceous areas with a predominance of piceous integument in basal region and apical 0.33; overlying pubescence mostly white and black setae, a small central area of golden setae covers approximately interstices 7, 8, and 9, setae of interstices, 3, 5 and 7 raised to form a ridge at apical end and sometimes also for length of elytra; apices of elytra rounded and strongly narrowed; legs fuscous with piceous patches and overlying integument of white and black over respective light and dark areas; prepectenar ridge of hind femur with several sturdy serrations, pecten with first spine strong, followed by about 7 spines about 0.33 as long as first spine.

Pygidium: Longer than broad, with lateral margins almost straight and apical margin evenly rounded in male, with medial notch in female; female with rounded tubercle medially situated, near apical border; integument of both sexes piceous with a predominance of piceous setae overlying it but intermingled with a small amount of white.

Male genitalia: (Fig. 43). Median lobe short, broad, strongly sclerotized; ventral valve with lateral margins concave, gradually narrowing to acuminate apex; dorsal valve narrower, lateral margins convex, gradually narrowing to rounded apex; armature of internal sac with 2 long, thin, slightly curving spines, situated side by side elongated to about 0.33 length of internal sac, spines spatulate, joined at their bases (Fig. 43); lateral

lobes elongate, narrow, broadened apically, apices rounded, with broad medial cleft, with many fine setae.

Female genitalia: Unknown.

Host Plants.—Unknown.

Type series.—Holotype ♂ and 4 paratypes: S. W. AFRICA: Okahandja, 3-9-ii-1928, S.W. Africa, R. E. Turner, Brit. Mus. 1928-119. One paratype same data except date 10-16-ii-1928. Holotype and paratypes deposited in the BMNH.

Distribution.—Namibia.

Etymology.—We are very pleased to name this species in honor of our friend and specialist on Old World bruchids, the late Dr. Jean Decelle of Belgium.

Discussion.—*Caryedon decellei* is in the *Interstinctus* Group. See discussion of *C. interstinctus* for a discussion and diagnosis of this species.

Caryedon decellei is similar to *C. interstinctus* and *C. multinotatus* in that all three species have an internal sac armed with two strongly sclerotized, elongated, spines that are spatulate and joined at their bases. *Caryedon decellei*, however, is distinct from others in the *Interstinctus* Group by having these spines elongated to only about one-third the length of the internal sac. Other species in the group lack similar spines or have longer spines.

Caryedon denticulatus (Klug)

Figs. 44–46

Bruchus (*Caryoborus* Schönh.) *denticulatus* Klug 1833: 187 (Holotype ♀: Madagascar. Goud; ZMB); Schoenherr 1839: 129.

Pachymerus denticulatus: Pic 1913: 7; Udayagiri & Wadhi 1989: 243.

Caryedon denticulatus: Wendt 1978: 355; Borowiec 1990a: 383, 1990b: 60.

Description.—Partly based on Borowiec (1990a). *General facies*: Integument fusco-testaceous to fusco-piceous; pronotum and elytra with indistinct, sparse, small dark spots; hind femur infuscate near middle; antenna, fore and mid legs reddish, unicolorous. Vestiture varying from yellowish-gray, moderately dense, not fully covering body surface, uniform to coarse pale golden on silver pubescence with scattered maculations covered with dark setae. Length 5.9–7.0 mm. Width 3.0–3.6 mm.

Head: Ferruginous to fuscous, sometimes

with purplish tinge, moderate in length, distance from base of antenna to apex of labrum about 0.5 distance from upper limits of eyes to apex of labrum; frons narrow, with sharp median, glabrous carina, in narrowest part about as wide as three ocular facets together, surface punctate on either side, coarsely overlaid with fine white pubescence; ocular sinus about 0.2 times as long as eye; eye with large facets; tempora obsolete; antenna fusco-ferrugineous, antennal segments 1–4 filiform, segment 1 approximately 3 times longer than 2, segments 5–10 elongate, serrate, about 2.0–2.2 times longer than wide, 11 about 3 times longer than wide, long and unevenly acuminate, antenna reaching to 0.5 body length.

Pronotum: Pentagonal, apical 0.5 acutely conical, basal 0.5 of lateral margin slightly arcuate; about 1.5 times wider than long, disc slightly flattened with two small pits before middle, densely punctate, distance between punctures about 0.5 as wide as diameter of puncture; lateral carina extending from base to about 0.6 distance to anterior edge of pronotum; prosternum separating procoxae for about 0.3 their length; pronotum fuscous with purplish tinge varying to fusco-ferrugineous with 4 small dark maculate spots situated on either side of median line, one pair near the apical margin, the other pair near basal margin; overlying pubescence coarse, silvery-white, almost completely covering integument.

Scutellum: Small, longer than broad, rounded at apex, covered with long, white setae.

Meso- and Metathorax: Elytron 2.9 – 3.0 times longer than wide, slightly truncate at apex; fusco-ferrugineous to fuscous with few maculations scattered over elytron, maculations almost invisible under short, coarse pale-golden to gray-fawn, elytral pubescence sometimes with dark setae over maculate areas; striae moderately deep, distinctly punctate amongst thick covering of adpressed pubescence, intervals smooth; striae 2 and 3, and 4 and 5 closer to one another at base than to adjacent striae; striae 4 and 5 shortened posterad, 3 and 8 closed posterad; apices of elytra truncated inwards towards suture; legs 1 and 2 testaceous to fuscous, hind pair darker, of same coloration as remainder of the insect; hind femur about twice longer than wide, femoral pecten with 14 spines, first spine about twice longer than second, remaining spines gradually smaller, prepectenal ridge serrate (Fig. 23); hind tibia

strongly arcuate, with complete set of carinae, mucro about as long as tibial apex.

Abdomen: Unmodified, last sternum not emarginate; pygidium longer than broad, lateral margins almost straight, male with lateral margins slightly arcuate, rounded at apex; integument fusco-rufous to fusco-testaceous with testaceous area at apex, pubescence of mixed, long, fine, dark and golden setae, with white setae at apex varying to sparsely placed long golden, erect pubescence over whole pygidium; females without golden, erect setae.

Male genitalia: (Fig. 44). Median lobe slightly elongate; ventral valve broad with lateral margins convex gently narrowing to a small, acuminate apex, dorsal valve narrow, lateral margins convex, narrowing to an acuminate apex; internal sac armed with two groups of moderately large spines, one group of about 18 short, stout spines arising from a central axis about 0.33 from base, apical to these near middle a series of short spines, intermixed with very small spines, near apex another group of spines but with a long chain of stout spines, some longer than others, all intermixed with very minute spines (Fig. 44); lateral lobes well developed, cleft at apex, apices straight, not curved, with many long, sturdy setae, inner face of lateral lobes with a number of small spines or setae, outer face strongly sclerotized.

Female genitalia: (Figs. 45, 46). Ovipositor very long, base divided into two lobes (Fig. 45); without vaginal sclerites; spiculum ventrale with moderate cleft (Fig. 46); bursa copulatrix with group of sturdy spines.

Host Plants.—Unknown.

Distribution.—Madagascar. (Borowiec 1990a: 383, 1990b: 60.)

Discussion.—*Caryedon denticulatus* is in the *Denticulatus* Group. BJS separated *C. denticulatus* and *C. vinsoni*, the two members of the *Denticulatus* Group, from all other *Caryedon* by indicating that the length of the denticles and the number of denticles on the prepectenal ridge and pecten of the hind femur were approximately equal on both sides of the first spine of the pecten (Fig. 23). All other species of *Caryedon* have a prepectenal ridge of the hind femur that is without denticles or at most with a number of serrations (Fig. 1).

The type specimen of *C. denticulatus*, which forms part of the comparatively little known bruchid fauna of Madagascar, was the only speci-

men available to BJS when he made his initial study. BJS was unable to obtain an illustration of the male genitalia of this species. Since then, Borowiec (1990a) described a male specimen that he considered to be *C. denticulatus*. CDJ agrees with the results obtained by Borowiec (1990a). In addition to the specimens used by Borowiec in his studies, specimens have become available to CDJ that are the same species as the others, all from Madagascar. *Caryedon denticulatus* differs from other *Caryedon* in that it is one of the largest species in the genus, as only *C. multinotatus*, *C. gigas*, *C. grandis* and large specimens of *C. serratus* (Olivier) are similar in size. *C. multinotatus* differs because its antennal color is variegated, while in *C. denticulatus* the antennae are unicolorous. Species of the *Serratus* Group differ in that they have elytra with distinct spots of darker hair while in *C. denticulatus* the elytra are uniformly pubescent. We agree with Borowiec's interpretation of the male genitalia as the other member of this group, *C. vinsoni*, has an elongate radular structure in the internal sac of the male genitalia (Figs. 108, 146) that is distinct from *C. denticulatus* but not nearly as well defined as the radular structure of males of *C. denticulatus* (Fig. 44). The structure of the armature of the hind femur and of the internal sac of the male genitalia links these two species into the *Denticulatus* Group.

Caryedon dialii Decelle

Figs. 47–49

Caryedon dialii Decelle 1973: 600 (Holotype ♂: Zaïre (now Democratic Republic of the Congo), region du Haut-Zaïre, Yangambi; MRAC); Wendt 1978: 355; Rasplus 1988: 64; Udayagiri & Wadhi 1989: 229; Delobel *et al.* 1995b: 81; Silvain & Delobel 1998: 534.

Description.—Translated and paraphrased from Decelle (1973). *General facies:* Coloration uniformly reddish brown, pronotum and underside sometimes a little darker, clypeus and labrum dark brown, antennal segments 5–11 black; pubescence gray with golden reflections, sericeous, recumbent, very fine, uniform. Length 5.5 mm to 6.2 mm.

Head: Including eyes, narrower than pronotum; frons with well-marked longitudinal carina extending from clypeus to postocular constriction; frons and vertex very densely punctate, finely rugose; clypeus and labrum more dark than

frons, vertex and mandibles; antenna elongate, equaling approximately 0.5 length of body, all segments longer than wide; segment 1 rather long and large, equaling 2–3 together, 2 short, 3 longer, 4 a little less short than 3, 5–10 elongate, slightly serrated; antennal segments 1–4 red, 5–10 black, apex of segment 11 slightly red; palpi reddish.

Pronotum: Narrow in proportion to elytra, 1.5 times as wide as long; rounded at apex, lateral margins nearly straight and parallel, not enlarged until near base; base feebly rounded from two sides of antescutellar lobe; base, apex and rear of lateral margins with a very distinct rim; punctation double and dense; coloration dark red, uniform; base, apex, and lateral margins with a very fine black border; pubescence fine, short, recumbent, not covering all of integument.

Scutellum: Small, rectangular, slightly longer than wide, very densely pubescent.

Meso- and Metathorax: Elytra elongate, 3.3 to 3.5 times longer than pronotum, and 1.5 times longer than at their widest, slightly dilated at their anterior 0.33, then feebly narrowed, their apices separately rounded at medial margins; striae fine, well marked for entire length, formed of elongate punctations almost contiguous with but not touching the strial intervals, the latter subequal, very regularly alutaceous, sutural strial interval projecting slightly throughout apical 0.66; coloration uniform red; pubescence sericeous, gilded, very fine and regular; posterior tarsi a little darker than the anterior and middle tarsi; pecten of hind femur with first spine followed by 10–11 spinules; ventral surface with uniform coloration, slightly darker than dorsal surface; with very fine, dense punctations; covered with uniform, recumbent pubescence; last abdominal segment slightly emarginate at apex.

Pygidium: In form of a shield, slightly longer than wide, feebly convex, very regularly alutaceous and covered with a fine sericeous pubescence, uniform and dense.

Male genitalia: (Fig. 47). Median lobe moderate in length and width; ventral valve short and narrow, with lateral margins deeply concave, terminating in acuminate apex, dorsal valve narrow, lateral margins convex, apex acuminate; armature of internal sac with 8 spines arranged as follows: with two, large, recurved spines at base, each with small spine on its base, two slightly curved medial spines, and four narrow spines at apex (Fig. 47).

Female. When compared to male: antenna not as long as in male; eyes smaller, slightly more distant from each other; pygidium longer than wide, less convex and less curved ventrally; last abdominal segment not emarginate.

Female genitalia: (Figs. 48, 49). With seven vaginal sclerites: anterior pair curved laterally, posterior pair very small above uneven plaque (Fig. 48); neck of bursa copulatrix with ring of sharp spinules, bursa copulatrix lined with small spinules; spiculum ventrale slightly elongate (Fig. 49).

Host Plants.—*Old records*: *Dialium guineense* (Rasplus 1988: 64; Delobel *et al.* 1995: 81); *D. pachyphyllum* (Decelle 1973a: 602; Udayagiri & Wadhi 1989: 229); *Prosopis africana* (Delobel *et al.* 1995: 81).

New records: None.

Distribution.—Zaire (now Democratic Republic of the Congo), Congo, Togo (Decelle 1973: 596). Ivory Coast (Rasplus 1988: 64). Senegal (Silvain & Delobel 1998: 534).

Discussion.—*Caryedon dialii* is in the *Acaciae* Group. See *C. acaciae* for a discussion of this species and other members of Subgroup 5.

***Caryedon elongatus* Johnson, Southgate & Delobel,
new species**

Fig. 50

Description.—*General facies*: Integument testaceous, with extreme lateral margins of thorax, humeral callosities and band across apical 0.33 of elytron dark; integument with silver-whitish pubescence. Length 7.5–8.0 mm. Width 3.0–3.5 mm.

Head: Testaceous except black spot in middle of clypeus and two small black spots on neck region; median carina present and very prominent, pubescence long and fairly thick on head sometimes obscuring the carina; eyes prominent with large facets; antenna pale testaceous.

Pronotum: Transverse, lateral margins with basal 0.66 straight, apical 0.33 angled, but not acutely so toward apical edge; integument testaceous except for lateral margins of thorax that are black from a point approximately 0.25 from basal angle to apical edge and gradually extending inward, also with two black spots a little inwards from basal angle; surface punctured with large irregular punctures; with thick silver pubescence.

Scutellum: Longer than broad, covered with white pubescence.

Meso- and Metathorax: Elytra much longer than

broad, apices rounded, striate, striae with shallow punctures; integument testaceous, except for black maculations covering stria intervals 7–8 and 9 and extending from humeral callosities apically for approximately 0.5 length of elytron; also with narrow, black, transverse band across apical 0.33 of elytron; (one of the two specimens available has this apical band considerably reduced in intensity); pubescence thickly covering integument, of uniform silver color, even over dark integument; legs 1 and 2 very pale testaceous, hind leg slightly darker; prepectenar ridge of hind femur with large number of serrations, pecten with large, parallel-sided first spine and 11 smaller denticles.

Pygidium: With testaceous integument overlaid with fine setae of uniform color.

Male genitalia: (Fig. 50). Median lobe short, broad; ventral valve with lateral margins convex, gently curved to blunt apex; dorsal valve with lateral margins concave, apex blunt; armature of internal sac with 8 spines arranged as follows: with a cluster of spines at base composed of two very large spines broadened in middle and spatulate at apical end, and two pairs of shorter spines with broad bases, near apex a pair of longer spines with serrate inner edges, pointed apices and broad rounded bases (Fig. 50); lateral lobes narrow with broad apices, with slight medial cleft, lobes evenly sclerotized except for extreme margins at the corners that are slightly more sclerotized, many fairly stout setae at apices.

Female genitalia: Unknown.

Type Series.—Holotype ♂: SOUTH AFRICA: Kaapmuiden, O-Tvl., M. Krige, 14.9.64, Ac X2105, Ex *Combretum suluense* seed. Paratype ♂: SOUTH AFRICA: Kaapmuiden, O-Tvl., M. Krige, 20.8.1964, Ac X2104, Ex *Combretum suluense* seed. Apparently, BJS was aware that O-Tvl. was an abbreviation for Oos-Transvaal, Afrikaans for East Transvaal. Elizabeth Grobbelaar of the SANC confirmed that the host is indeed *Combretum suluense* and that the actual collection locality was "13.1 miles from Kaapmuiden to Nelspruit" according to the records of the SANC. Holotype and paratype deposited in the SANC.

Host Plants.—*Combretum suluense*.

Distribution.—Transvaal, Mpumalanga Province, South Africa.

Etymology.—This species is named because of its relatively elongate body.

Discussion.—*Caryedon elongatus* is in the

Longipennis Group. See discussion of *C. longipennis* for diagnosis and discussion of *C. elongatus*.

Caryedon elongatus has a strong affinity with *C. conformis* but is in a different species group. It differs from that species and others in that it is much more elongate than other species. The hind femur has a greater number of denticles than most species of *Caryedon* and the large first spine of the pecten is of a different shape. It is unfortunate that the only specimens available had only a small number of antennal segments present.

***Caryedon fasciatus* Prevelt**

Figs. 51, 150

Caryedon fasciatus Prevelt 1965: 537 (Holotype ♂: Zaria Province, near Anara Forest Reserve, Nigeria; BMNH); Prevelt 1966: 13, 1967a: 4, 1971: 258; Johnson & Kingsolver 1975: 328; Southgate 1979: 458; Pfaffenberger 1985: 1; Udayagiri & Wadhi 1989: 229.

Description.—*General facies:* Integument fusco-ferruginous with maculate areas on thorax and elytra, pubescence of golden setae with darker setae over maculate integument in male and silver setae with less evidence of dark setae over maculate areas in female. Length 5.1–7.0 mm. Width 2.6–4.0 mm.

Head: With prominent median carina, punctate on either side and overlaid with silvery white pubescence, eyes set fairly wide apart, distance equal to length of antennal segment 2; eyes prominent with large facets; antenna with segment 1 approximately twice length of segment 2, segments 5–11 strongly serrate, segments as long as broad, segment 11 unevenly acuminate, antenna testaceous.

Pronotum: Transverse, lateral margins with basal 0.5 straight and apical 0.5 acutely conical; integument fusco-ferruginous with variable black markings, surface punctate with unevenly spaced punctures; male pubescent, with coarse, golden setae with dark setae over dark integument, female pubescent, with overall coarse silver setae without dark setae or dark integument.

Scutellum: As broad as long, covered with golden setae in male and silver to white setae in female.

Meso- and Metathorax: Elytra together broader than long, apices truncated, integument fuscous with scattered maculate areas and with a broad band of black across apical 0.33; pubescence gold-

en in male with dark setae over dark integument; basal area between humeral callosities and apically below dark band appear lighter than rest of elytron; female with silver to white pubescence even over dark integument but with a few dark setae intermixed over dark integument, apical area very pale; legs 1 and 2 testaceous with a few maculations, hind pair same color as elytra and with many maculations; prepectenal ridge of hind femur serrate.

Pygidium: In male as broad as long with slightly arcuate lateral margins and truncate apex, integument ferruginous with dark basal areas basally on either side of the median line; pubescence golden with dark setae over dark integument; female with pygidium longer than broad, lateral margins almost straight, apical end slightly truncated with a slight medial notch, integument black at base and along lateral margins except for a ferruginous patch at base on either side of median line, apical 0.33 fuscous and extending basally along midline for 0.66 its length; pubescence of fine black setae over dark integument with coarse white pubescence over lighter integument.

Male genitalia: (Fig. 51). Median lobe short and broad; ventral valve with concave lateral margins, slightly convex before apex then slight concavity near apex, apex broad, apex with concavity; dorsal valve narrower, lateral margins sinuate narrowing to an acuminate apex; armature of internal sac with 10 spines arranged as follows: with a clump of spines near base consisting of a pair of long curved spines broadened at base and pair of short, thickened, curved spines broad at one end and hooked at the other, slightly apical to these two pairs of shorter, slightly curved spines, apical to these a pair of thin, more elongate, sharply pointed spines with broadly spatulate bases (Fig. 51); entrance to ejaculatory duct campaniform; lateral lobes elongate, expanded at apices, apices rounded with slight medial, apical cleft, long setae at their apices.

Female genitalia: (Fig. 150). Vaginal sclerites consist of a large oval plate lightly sclerotized with areas of pale brown, posterior to this another oval disc with no sclerotization; neck of bursa copulatrix armed with a number of large spines surrounding a central plate followed by an area covered by minute spines; bursa copulatrix unarmed.

Host Plants.—*Old records:* *Combretum lamprocarpum* (Prevelt 1965: 538, 1967a: 5; Southgate 1979: 458; Udayagiri & Wadhi 1989: 229).

New records: None.

Distribution.—Nigeria.

Discussion.—*Caryedon fasciatus* is in the *Serratus* Group, Subgroup 2. See *C. serratus* for a discussion of this species.

Caryedon fathalae Delobel

Figs. 52–56

Caryedon fathalae Delobel 1997: 391 (Holotype ♀: Sénégal, Région de Fatick, forêt de Fathala; MNHN); Silvain & Delobel 1998: 534.

Description.—Translated and paraphrased from Delobel (1997). Female. *General facies:* Integument generally dark brownish-red, appearing to the naked eye to be almost black; legs (especially forelegs) paler; all of body clothed with recumbent, dense, whitish pubescence. Length 4.8–6.3 mm.

Head: With well-marked interocular carina extending to vertex, surface glabrous and glossy. Maximum distance between eyes: dorsally 0.11 times maximal width of head; ventrally 0.23 times width of head; antennal segments with ratio: 2.1; 0.9; 1.2; 1; 1.9; 1.9; 2.1; 2.1; 2.3; 2.3; 2.7 (segment 4 taken as a unit of length), enlarged apically beginning with segment 5.

Pronotum: In dorsal view (perpendicular to disk) 1.4 mm long in holotype (1.4 mm on average; varies from 1.1 to 1.5 mm), greatest width at base, at 1.5 times wider than long; lateral margins near apex strongly oblique then forming abrupt angle at 0.33 length of pronotum, width of pronotum at this level represents 0.84 times its maximum length; remainder of lateral margins almost parallel, straight or very slightly concave; disk with large, deep, round punctations with variable density: very dense in front and at center, they are separated by many times their diameter on lateral margins; between these punctations, small, irregularly distributed areas of dense setae; short, glabrous line at base.

Scutellum: With rounded apex.

Meso- and Metathorax: Elytra 3.1 times longer than pronotum and 1.58 times longer than greatest width of elytra together; length at suture, measured perpendicular to disk: in holotype, 4.7 mm (4.3 on average; range 3.7 to 4.8 mm); lateral margins expanded to 0.4 their length, then curved normally; with fine, deep striae, marked with small, setiferous punctations; stria intervals flat

to slightly convex, with dense setiferous punctations (about 8 to 10 setae for length of one interval); humeral callosities marked, surface of elytron slightly wavy behind; striae 2–3, 4–5, 6–7 joined at apex; stria 9 incomplete at same distance from base as 6–7, stria 10 incomplete at intermediate distance from base between striae 4–5 and 6–7; metathoracic femur strongly dilated, suboval, internal surface almost flat, prepectenar ridge formed of 8 (7 to 9) closely grouped, small spines, pecten with large spine followed by 11 smaller spines (varies from 9 to 11); metathoracic tibia with 5 well-marked, longitudinal carinae, two dorsal carinae only on apical 0.5, mucro at apex.

Abdomen: With sternum one 0.61 times total length of abdomen.

Pygidium: Slightly longer than wide at base, slightly convex on disk, apex truncated, with small preapical, medial concavity; pubescence of apical portion of pygidium same as general pubescence.

Female genitalia: (Figs. 52, 53, 54). Ovipositor short, sterna 8 and 9 with characteristic chitinous thickening; vagina membranous, devoid of sclerites; bursa copulatrix with two series of spicules, first series annulate, at entrance, second series with 10 spicules situated on ventral surface, at about 0.25 to 0.33 length of bursa copulatrix (Fig. 54).

Male. Identical to female, except antennal segments with the ratio: 2; 0.8; 1.1; 1; 1.5; 1.6; 1.6; 1.8; 1.8; 1.8; 2.2; pronotum in allotype 1.4 mm long (1.4 on average; from 1.3 to 1.4 mm), elytra 4.3 mm (4.2 on average; from 3.8 to 4.4 mm); last visible abdominal sternum slightly narrower than female; pygidium wider at base than long, apical margin narrow or convex, without preapical, medial concavity.

Male genitalia: (Figs. 55, 56). Median lobe short, ventral valve triangular, elongated into acuminate apex; internal sac devoid of spines, lined with microspinules, more microspinules dorsally than ventrally, subapical inflated zone with spicules oriented toward base (Fig. 55); lateral lobes short, completely fused, scarcely cleft at apex (Fig. 56), with many fine, elongate setae at their apices, base of lateral lobes with large dorsal apodeme and smaller, ventral apodeme.

Host Plants.—*Old records:* *Terminalia macroptera* (Delobel 1997: 392).

New records: None.

Distribution.—Senegal.

Discussion.—*Caryedon fathalae* is in the *Acaciae* Group. See *C. acaciae* for a discussion of this species.

Along with *C. immaculatus* and *C. macropterae*, *C. fathalae* is one of three unicolorous species infesting the Combretaceae of West Africa. *Caryedon fathalae* is characterized by its almost black tint and by the absence of spines in the internal sac of the male genitalia (Fig. 55).

***Caryedon fuliginosus* Prevelt**

Figs. 57, 151

Caryedon fuliginosum Prevelt 1965: 540 (Holotype ♂: Kano Province, near Paki, Nigeria; BMNH); Prevelt 1966: 12, 1967a: 5, 1971: 258; Pfaffenberger 1985: 1; Udayagiri & Wadhi 1989: 229; Delobel *et al.* 1995b: 81; Silvain & Delobel 1998: 534.

Description.—*General facies*: Integument an overall mixture of fuscous and maculate areas overlaid by light and dark colored pubescence giving entire insect a speckled appearance. Length 4.0–6.4 mm. Width 2.0–3.4 mm.

Head: With integument fuscous; pubescence silver; median carina a glabrous line at base, prominent at apex; space between eyes equal to length of antennal segment 2, eyes coarsely faceted; antenna serrate to subserrate, dark fuscous, except segments 2–4 and apex of 11 fuscous to testaceous.

Pronotum: Transverse with less angulate lateral margins than most other species in this monograph, integument fuscous, some maculations principally in central region along midline and slight areas of darkening along apical lateral margins, surface with large irregularly spaced punctures; pubescence mostly silver or pale fawn with some dark setae over dark integument.

Scutellum: As broad as long with either white or fawn setae.

Meso- and Metathorax: Elytra together longer than broad, with apices very slightly truncated; integument with some fuscous areas, mainly in basal region and along either side of sutural line, in regions of lateral margins and across apical 0.33 are large areas of maculations sometimes continuous; pubescence consists of fawn setae over fuscous integument with dark brown and black setae over maculate areas; legs 1 and 2 fuscous with maculations on femora and tibia, hind pair with many more maculate areas; prepectal ridge of

hind femur elongate and serrate, pecten with first spine of moderate length followed by 6–7 smaller spines.

Pygidium: As broad as long or slightly longer than broad; apically rounded in the male and truncated in the female; integument variable from all black to black along basal region and partially down lateral margins toward a fuscous apex; pubescence dark over dark integument and fawn over fuscous integument, sometimes with a golden median line.

Male genitalia: (Fig. 57). Median lobe short and broad; ventral valve with straight lateral margins gradually narrowing to an almost acuminate apex, strongly sclerotized at extreme apex; dorsal valve very broad, as broad as apex of median lobe, lateral margins convex gradually narrowing to rounded apex; armature of internal sac with 6 spines arranged as follows: with two large U-shaped spines near base, apical to these a second pair of slender, slightly curved spines, spatulate at base, another longer, almost straight pair with rounded slightly bulbous basal ends near apex of sac; end of ejaculatory duct lightly sclerotized and covered in hardly discernible small spines (Fig. 57); lateral lobes narrow, elongate, expanded at apices, lightly sclerotized except for extreme lateral margins, apices mushroom-shaped, slightly rounded at apices, with moderate medial cleft, apices with several sturdy setae.

Female genitalia: (Fig. 151). Vaginal sclerites composed of large heart-shaped plate with apical 0.5 strongly sclerotized and central area forming a division by pattern embossed upon it, over this plate a smaller plate of similar shape which has a sinuous line medially across it; neck of bursa copulatrix with armature similar to *C. lunatus* and *C. immaculatus* differing in shape of larger spines, spines across apical end of neck larger and thinner, basal set being fewer and more parallel sided and not in shape of an arrowhead as in other species; area between two sets of major spines more or less devoid of small spines as in *C. fasciatus*.

Host Plants.—*Old records*: *Combretum ghasalense* (Prevelt 1965: 541, 1967a: 5; Udayagiri & Wadhi 1989: 229); *C. glutinosum* (Prevelt 1965: 541, 1967a: 5; Udayagiri & Wadhi 1989: 229; Delobel *et al.* 1995: 81).

New records: None.

Distribution.—Nigeria. Senegal (Delobel *et al.* 1995b: 81).

Discussion.—*Caryedon fuliginosus* is in the *Serratus* Group, Subgroup 1. See *C. serratus* for a discussion of this species.

***Caryedon germari* (Küster)**

Figs. 58–61

Caryoborus germari Küster 1845: 37 (Syntype: Dalmatian; DEI); Schilsky 1905: XXXI, 7a (as junior synonym of *C. pallidus*).

Pachymerus germari: Pic 1913: 8 (as junior synonym of *C. pallidus*).

Caryedon germari: Decelle & Lodos 1989: 166; Udayagiri & Wadhi 1989: 232; Borowiec & Anton 1993: 146; Anton et al. 1997: 61; Anton 1998: 74.

Caryedon lisaiae Southgate 1971: 413 (Holotype ♂: Armenia: Erevan; ZMAS); Zampetti 1984: 403; Borowiec 1984: 295, 1990a: 387; Karapetian 1985: 35; Udayagiri & Wadhi 1989: 231.

C. lisaiae: Southgate 1979: 460; Decelle & Lodos 1989: 166. Incorrect subsequent spelling.

Description.—*General facies*: Fusco-testaceous to fusco-rufous. Length 4.0 mm. Width 2.0 mm.

Male. Head: Fusco-rufous with sparse, fine, silver pubescence, median carina barely visible; eyes set widely apart, distance between eyes equal to length of first antennal segment; antennal segments 1–4 rounded, first segment almost twice as long as second, segments 5–10 serrate, each segment longer than broad, apical segment long, slightly unevenly acuminate, whole antenna fusco-testaceous at base becoming fusco-rufous toward apex.

Pronotum: Transverse, basal 0.66 of lateral margins slightly arcuate, apical 0.33 acutely convergent; fusco-testaceous to fusco-rufous; pubescence silver varying from sparse to moderately thick.

Scutellum: Longer than broad.

Meso- and Metathorax: Elytra unicolorous, fusco-testaceous to fuscous, together longer than broad, apices rounded; pubescence of coarse silver setae; legs fusco-testaceous, hind femora sometimes fusco-rufous; prepectal ridge of hind femur with one or two small spines, pecten with eight spines preceded by a median spine barely distinguishable in size from other spines.

Pygidium: As broad as long, lateral margins slightly arcuate, apex truncated; cuticle fusco-testaceous to fusco-piceous in some examples (dark specimens also have very dark abdomens); pubescence silver.

Male genitalia: (Fig. 58). Median lobe short and broad; ventral valve with lateral margins a broad, sclerotized band, lateral margins concave, narrowing to acuminate apex, dorsal valve broad, slightly concave near acuminate apex; internal sac armed with six spines as follows: medially with pair of large hook-shaped processes with rounded apices, with a triangular area of small spines which sometimes partially obscure hook-shaped processes; apical to these a pair of narrow spines strongly acuminate apically, rounded basally, these flanked by a pair of U-shaped spines with outer margins of each broader and more strongly sclerotized than inner margin, apices of spines finely acuminate (Fig. 58); entrance to ejaculatory duct campanulate; lateral lobes scarcely sclerotized, rounded, apices truncated, with V-shaped median cleft, apices with numerous setae of varying length.

Female. Differs from male only in that pygidium is slightly longer than broad, with lateral margins arcuate and apex rounded; pygidial cuticle fusco-rufous with lighter margins.

Female genitalia: (Figs. 59, 60). Elongated V-shaped spiculum ventrale (Fig. 59) and long, thin oviposition lobes (Fig. 60); vaginal sclerites and bursa copulatrix lightly sclerotized without a characteristic pattern or armature.

Host Plants.—*Old records*: *Lisaea heterocarpa* (Bagdasaryan 1941: 321; Lukianovich & Ter-Minasian 1957: 63; Southgate 1971: 411, 1979: 460; Udayagiri & Wadhi 1989: 231, 233).

New records: None.

Distribution.—Dalmatia, Armenia. Caucasus, Crimea (Southgate 1971: 413). Bulgaria, Georgia, Turkey, Greece, Dalmatia, Herzegovina, Macedonia (Borowiec 1990a: 387; Decelle & Lodos 1989: 166).

Discussion.—*Caryedon germari* is in the *Acaciae* Group. See *C. acaciae* for a discussion of this species and other members of Subgroup 6.

Bagdasaryan (1941) and Lukianovich & Ter-Minasian (1957) identified *C. germari* as *C. pallidus* when they discussed it as feeding in seeds of *Lisaea heterocarpa*. Southgate (1971) studied specimens of this bruchid and found it to be a new species that he named *C. lisaiae* and cited the host record on other occasions (Southgate, 1979). Decelle & Lodos (1989) synonymized *C. germari* with *C. lisaiae*. The male genitalia of *C. germari* and *C. pallidus* are distinctly different. The two pairs of the most apical spines of *C. pallidus* (Fig. 97) are

clumped medially and thus are similar to *C. germari*. But *C. germari* differs in that it has medial, obscure, hook-shaped processes in the internal sac that are often embedded in a triangular area of small spines that sometimes partially obscures the hook-shaped processes. In addition, the ventral valve of *C. germari* has lateral margins with a broad, sclerotized band (Fig. 58).

Decelle & Lodos (1989) synonymized *C. germari* with *C. lisaeae* but gave no explanation for the synonymy. The holotype of *C. lisaeae* is in the ZMAS and we found a syntype of *C. germari* in the DEI. Apparently syntypes of *C. germari* are deposited in museums or private collections in Europe but because the type series of *C. germari* was collected in small numbers in a garden in Tra-u in Dalmatia, relatively few of the syntypes are apparently available today.

While explaining the behavior of *C. germari* (as *C. lisaeae*), Southgate (1979) indicated that *C. lisaeae* was conspecific with *C. pallidus*, thus seeming to synonymize the two species. We interpret Southgate meant that previous authors (Bagdasaryan, 1941; Lukianovich & Ter-Minasian 1957) identified the species feeding in *Lisaea heterocarpa* as *C. pallidus*.

Several bruchids in the genera *Bruchidius*, *Bruchus*, and *Eubaptus* that were collected on or in seeds of the Apiaceae have been reported in the literature (Bridwell, 1934; Bagdasaryan, 1941; Hoffmann, 1945; Zacher, 1952; Terán, 1967; Borowiec, 1980). According to Bagdasaryan (1941) and cited by Lukianovich & Ter-Minasian (1957), *Caryedon germari* feed in seeds of *Lisaea heterocarpa*. Bagdasaryan (1941) studied the life history of *C. germari* (as *C. pallidus*). Bagdasaryan observed that females of this species oviposited one or two eggs on the thorny fruits. Larvae entered the fruit, fed upon seeds and, when mature, emerged from the fruit and pupated in a cocoon on the surface of the fruit (Fig. 61). Producing a cocoon and pupating outside a seed or fruit is unusual for bruchids but common in species of *Caryedon*.

***Caryedon gigas* Johnson, Southgate & Delobel,
new species**

Figs. 62, 63

Description.—*General facies:* Pale golden setae over dark fuscous integument. Length 8.4–9.0 mm. Width 4.3–4.5 mm.

Head: Broad, median carina present but not prominent; eyes small not prominent, space be-

tween eyes nearly equal to width of one eye, inner edge of eye ending in a slight ridge; integument black gradually becoming very dark reddish brown toward base of head; surface of head reticulate on clypeus, becoming punctate on either side of median carina toward base; sparsely covered with golden setae, with a row of upstanding setae around rim of eye; antenna black, segments 1–4 rounded, segment 2 approximately 0.5 as long as segment 1, segments 5–10 serrate, each segment as broad or slightly broader than long, apical segment obliquely truncate and quadrate.

Pronotum: Conical, lateral margins very slightly arcuate for basal 0.5, apical 0.5 oblique, basal edge produced medially, more so than other species of *Caryedon*; integument dark reddish fuscous; irregularly punctate with large punctures, surface between punctures reticulate; thickly covered with golden pubescence.

Scutellum: Longer than broad with long golden pubescence completely covering integument.

Meso- and Metathorax: Elytra together slightly longer than broad, apex of elytra rounded; integument fusco-rufous with black maculations in varying proportions overlaid with adpressed golden pubescence; some examples have dark pubescence over dark integument; striate, striae visible as well defined lines in pubescence; legs testaceous to dark testaceous, pubescence of legs similar to rest of insect; hind femur variable in color of integument and pubescence, prepectenar ridge without serrations, pecten armed with large first spine followed by 10 denticles.

Pygidium: Longer than broad, lateral margins straight in male but female about same width as length, lateral margins arcuate; integument fusco-rufous with black areas of varying shape overlaid with coarse, golden pubescence.

Male genitalia: (Fig. 62). Median lobe short and broad; ventral valve strongly sclerotized, narrow with broad base and concave lateral margins, apex acuminate, dorsal valve broad, lateral margins convex, apex acuminate; armature of internal sac with 6 spines arranged as follows: at base a pair of strongly curved, pointed spines broadened to a spatulate base, apical to these a pair of smaller, thin, straight spines with curved spatulate bases, and a very small pair of spines apical to these, at apex sac lined with very minute spinules (Fig. 62); lateral lobes narrow, elongate, expanded and rounded at apices, with very slight medial cleft, many elongate setae at apices, setae more numerous medially.

Female genitalia: (Fig. 63). Vaginal plates more or less triangular with narrow end toward base, this area lightly sclerotized and appears as a number of folds with central portion consisting of a number of longitudinal lines composed of minute spines or setae, remaining area also has these setae but not forming a pattern, neck region and bursa copulatrix not ornamented in any way; spiculum ventrale and ovipositor lobes differ from other *Caryedon* in that both of these parts of the genitalia are divided into two separate parts right and left whereas they are normally joined together to a common base, basal end of ovipositor lobes also club shaped and ornamented with spines at apices.

Host Plants. Unknown.

Type series.—Holotype ♂: MADAGASCAR: Sakaraha, Lambomakandro, P. Griveaud. One paratype: MADAGASCAR: Sakaraha, Lambomakandro, A. R. Two paratypes: MADAGASCAR: Andobo, 190m, forêt Antsingy det Antsalova, -II-57, P. Griv. Holotype and two paratypes deposited in the MNHN. One paratype deposited in the BMNH.

Distribution.—Madagascar.

Etymology.—The specific epithet *gigas* (Latin, giant) is a noun in apposition to *Caryedon*.

Discussion. *Caryedon gigas* is in the *Acaciae* Group. See *C. acaciae* for a diagnosis and discussion of this species, and other members of Subgroup 6.

Caryedon gigas has the largest body size of any species of *Caryedon* yet discovered and is quite outstanding in shape and coloration. It is surprising that such a large insect has been undescribed for so long. In 1966, BJS noted a single, unnamed specimen in the Pic collection, Paris. Apart from this, the only material available is a series borrowed from the Institut de Recherche Scientifique à Madagascar that consists of 14 examples from four localities in Madagascar. Unfortunately, no host plant data are available, but such a large insect must feed in very large seeds.

Caryedon grandis Decelle

Figs. 64–66

Caryedon grandis Decelle 1979b: 85 (Holotype ♂: Run, Somalia; MZLS); Udayagiri & Wadhi 1989: 229.

Description.—Translated and paraphrased from Decelle (1979b). *General facies:* Large species of reddish mahogany coloration, with some black

maculations on the elytra; covered by dense, recumbent, mostly beige pubescence; similar to *Caryedon serratus*. Length 6.3–7.5 mm (7.2–8.3 mm with head and pygidium).

Male. Head: With strong, longitudinal carina between eyes; eyes large, globular, scarcely separated dorsally; strong, transverse impression behind vertex; antenna reaching to 0.5 length of body, antenna dark red with segments 1 and 4–11 spotted black; antennal segment 1 elongate, segment 2 short, 3 slightly longer, 4 same length as 2, segments 4–10 eccentric, serrate, segment 11 elongate.

Pronotum: Wide, more than 1.5 times as wide as long; lateral margins elongate, subparallel, slightly concave near mid-length, strongly rounded on apical margins; disk with double punctations.

Scutellum: Small, subparallel, emarginate, densely pubescent.

Meso- and Metathorax: Elytra 3.3 times longer than pronotum, slightly less than 1.5 times longer than width of elytra together; lateral margins curved to lateral dilation near base, then straight and scarcely narrowed as far as their apical rotundity; striae fine, impunctate, striae intervals densely micropunctate; sutural striae interval projecting slightly throughout the apical 0.66; at apex 3rd, 7th, and 9th striae intervals slightly more convex than other intervals; disk of elytron slightly gibbous on striae intervals 3 to 5 slightly behind scutellum; basal depression on a level with striae interval 6; humeral callosity marked; elytral coloration dark red with black maculations, irregular; pubescence dense, uniform beige but darker fawn colored on black maculations; hind coxa polished, with very fine punctations, pubescence very fine and scarce; hind femur strongly incrassate but longer than wide; lateral margin with pecten formed of long, fairly narrow, acuminate 1st spine, followed by 12 spines 3 times as small as 1st spine; hind tibia carinate, strongly curved, mucronate at apex.

Underside of body: Reddish mahogany, darker on abdomen; covered with dense, beige pubescence, more fawn in places; last ventral segment shortened, apical margin emarginate; pygidium wider than long, slightly inclined, slightly convex before apex; red with 2 darker zones on lateral margins of base; pubescence mixture of beige and fawn color.

Male genitalia: (Fig. 64). Median lobe elongate, broad; ventral valve with concave lateral margins

narrowing to acuminate apex, dorsal valve slightly broader, lateral margins straight, narrowing to moderately acuminate apex (Fig. 64); armature of internal sac with 10 spines arranged as follows: with many fine spicules near spines, two large curved spines with large bases near middle of internal sac flanked by two short spines and two elongate spines; near apex four curved, U-shaped spines with medial portion of spines more elongate, thin and acuminate, lateral branches of spines shorter, larger, less attenuated extremities of these spines hidden by elongate spinules.

Female. Differs from male by its very short antenna not attaining 0.33 length of body; by its flat pygidium, very horizontal, longer than wide, with 2 longitudinal impressions along its lateral margins and feeble preapical convexity on its apical 0.33; last abdominal sternum elongate, not emarginate; spine 1 of pecten of metathoracic femur shorter than in male.

Female genitalia: (Figs. 65, 66). Of a type strongly resembling those of *C. serratus* but unique ventral plate of vagina shortened front and rear, but less distinctly so on the lateral margins (Fig. 65); spiculum ventrale with very broad apical branches (Fig. 66).

Host Plants.—Unknown.

Distribution.—Somalia.

Discussion.—*Caryedon grandis* is in the *Serratus* Group. See *C. serratus* for a discussion of this species and other members of Subgroup 3.

Caryedon immaculatus Prevett

Figs. 67, 152, 152

Caryedon immaculatus Prevett 1965: 542 (Holotype ♂: Nigeria: Mariri Forest Reserve, Kano Province; BMNH); Prevett 1966: 12, 1967a: 3, 1971: 258; Pfaffenberger 1985: 1; Delobel *et al.* 1995b: 81; Udayagiri & Wadhi 1989: 230; Delobel 1997: 393; Silvain & Delobel 1998: 534.

Description.—**General facies:** Integument fusco-testaceous, with sparse golden pubescence. Length 3.8–4.7 mm. Width 1.9–2.4 mm.

Head: Fusco-testaceous; median carina barely visible, surface on either side punctate; sparsely overlaid with fine golden pubescence; eyes widely separated equal to length of antennal segment 1; eyes less bulbous than most species with fairly coarse facets; antennal segments 5–11 serrate, seg-

ment 2 almost as long as segment 1, antenna testaceous.

Pronotum: Transverse, lateral margins straight for basal 0.66, apical 0.33 conical; integument fusco-testaceous to fuscous; surface punctate with large irregular punctures, pubescence of fine golden setae sparsely covering integument.

Scutellum: As long as broad, covered with white setae.

Meso- and Metathorax: Elytra together longer than broad, apices rounded, striae deeply punctate; integument fusco-testaceous to fuscous, overlaid with golden pubescence, sparsely covering integument; legs 1 and 2 testaceous, hind pair fusco-testaceous to fuscous; prepectenar ridge of hind femur with several well-defined serrations.

Pygidium: In male slightly broader than long, lateral margins arcuate toward narrowly pointed, evenly-rounded apex; integument fusco-testaceous overlaid with fine golden pubescence; female with pygidium longer than broad, lateral margins very slightly arcuate, apex narrow and unevenly rounded with a slight medial notch, surface with a small rounded medial tubercle near apical margin; integument fusco-testaceous to fuscous overlaid with long golden pubescence.

Male genitalia: (Figs. 67, 152). Median lobe short and broad; ventral valve broad with lateral margins slightly concave, apex acuminate, dorsal valve with base narrower, lateral margins slightly convex; armature of internal sac with 4 spines arranged as follows: sac with 4 spines near middle, two large, complex spines strongly curved, pointed and gradually broadened toward bases of spines and midway along inner side of spines two small protuberances with rounded apices, adjacent to large spines two short stout spines (Fig. 67); lateral lobes narrow, elongate, significantly expanded to rounded apices, very slight medial cleft, apices with several elongate setae (Fig. 152).

Female genitalia: (Fig. 153). Vaginal sclerites consist of almost circular plate, lightly sclerotized with central zone more pale, with dark sclerotized areas radiating from it; neck of bursa copulatrix with covering of fine spines with several longer spines in central area.

Host Plants.—**Old records:** *Combretum micranthum* (Prevett 1965: 544, 1967a: 5; Udayagiri & Wadhi 1989: 230).

New records: None.

Distribution.—Nigeria.

Discussion.—*Caryedon immaculatus* is in the

Acaciae Group. See *C. acaciae* for a discussion of this species and other members of Subgroup 6.

Caryedon interstinctus (Fåhræus)

Figs. 68–71, 154

Bruchus (subgen. *Caryoborus* Sch.) *interstinctus* Fåhræus 1871: 450 (Holotype ♀: Caffraria; NRS).

Pachymerus interstinctus: Pic 1913: 8; Skaife 1926: 579; Zacher 1952: 465; Prevett 1966: 9.

Caryedon interstinctus: Bridwell 1929: 145; Decelle 1958: 83; Southgate 1979: 459; Udayagiri & Wadhi 1989: 230; Borowiec 1990a: 385.

Description.—*General facies*: Integument fuscous to fusco-piceous overlaid with white and black setae forming a pattern on thorax and elytra. Length. Type is in too poor condition to obtain reliable measurements. Type is in too poor condition to obtain reliable measurements.

Head: Integument fuscous, more sparsely overlaid with pubescence than *C. albonotatus*; median carina prominent, extending well beyond length of eyes, both apically and basally; width between eyes wide at anterior edge, equal to length of antennal segment 1; eyes fairly prominent, coarsely faceted; antennal segments 5–11 serrate, segment 11 short, evenly acuminate; segment 1 nearly twice as long as segment 2 and partly darker in color; segments 2–4 testaceous, 5–11 alternately dark and light in color, with varying proportions of dark coloration.

Pronotum: Transverse; surface covered with large, unevenly spaced punctures; integument fuscous with maculate areas; pubescence pale golden with medial area of pubescence extending towards basal angles, pubescence white on lateral margins and medially near basal margin.

Scutellum: Longer than broad, slightly bifid and covered with white pubescence.

Meso- and Metathorax: Elytra slightly longer than broad; cuticle raised to form a hump in basal region covering interstices 3–5; integument mostly fuscous with scattered areas of maculations particularly at base and medially toward the sutural line in herringbone pattern, pattern along lateral margin toward apex; pubescence black over maculate areas, white along sutural line and lateral margins, golden medially; legs fuscous with maculations on femora and tibiae; prepectal ridge of hind femur with minute serrations.

Pygidium: Lateral margins slightly arcuate,

rounded at apex and very slightly notched medially with tubercle situated medially near apical edge, integument dark fuscous overlaid with golden pubescence.

Male genitalia: (Fig. 68). Median lobe short, broad; ventral valve with lateral margins convex, gradually narrowing to blunt apex; dorsal valve narrower, lateral margins convex, gradually narrowing to rounded apex; armature of internal sac with 2 spines arranged as follows: with 2 strongly sclerotized spines elongated to about 0.66 length of internal sac, spines spatulate and joined at their bases. Lateral lobes lost.

Female genitalia: (Figs. 69, 70, 71, 154). Variable in *C. interstinctus*. Spiculum ventrale and ovipositor lobes strongly sclerotized, comparatively short, each conforms to basic pattern of straight ovipositor lobes with a common spatulate base; spiculum ventrale approximately equal in length from apex of arched lateral margins, which are broadly thickened, to base of arch and from this point to a narrow base; vaginal sclerites extremely thin, consisting of 2 lightly sclerotized plates; neck of bursa copulatrix extends basally from this region armed with strong spines of varying sizes; bursa copulatrix not ornamented.

Host Plants.—*Old records*: *Acacia erioloba* (as *A. giraffae*; Zacher 1952: 471; Udayagiri & Wadhi 1989: 230); *A. horrida* (Zacher 1952: 471).

New records: None.

Distribution.—Caffraria. Belgian Congo (Decelle 1958: 83). South Africa, Namibia, Tanzania, Zaïre (now Democratic Republic of the Congo) (Borowiec 1990a: 385).

Discussion.—*Caryedon interstinctus* is in the *Interstinctus* Group.

Because both host plants were initially reported by Zacher (1952), they should be verified as some of Zacher's host records have proven to be inaccurate with other bruchids.

In the key to species groups BJS characterizes the *Interstinctus* Group as having "elytral maculations of integument and pubescence forming a herringbone pattern along sutural line" (Fig. 144). Here we distinguish the species in the group, *C. albonotatus*, *C. decellei*, *C. interstinctus*, and *C. multinotatus* from each other, based on the structure of the male genitalia. The internal sac of *C. albonotatus* is armed near its base with two long, slightly curving spines with slightly spatulate bases, flanked by a pair of shorter, thicker, straight spines (Fig. 28). This differs from the oth-

er three species that have the internal sac armed with two long, slightly curving spines, situated side by side, elongated to various lengths, and that are spatulate and joined at their bases. The length of the spines of the latter three is diagnostic. The spines of *C. interstinctus* are two-thirds the length of the internal sac (Fig. 68), those of *C. multinotatus* are one-half the length of the internal sac (Fig. 92) and those of *C. decellei* are one-third the length of the internal sac (Fig. 43).

Fåhræus (1871) described *Bruchus* (subgenus *Caryoborus*) *interstinctus* from 'Caffraria.' Pic (1935) described a new variety of his species *Pachymerus albonotatus* as var. nov. *multinotatus*, from Windhoek S.W. Africa (Namibia) as follows: "Diffère, à première vue, de la forme typique par les élytres ornés de dessins gris multiples, sans grand macule pubescente continue." An examination of the type of *C. multinotatus* shows that there is a strong external affinity with *C. interstinctus* that is also southern African. While collating material for this paper, BJS examined additional material from the Skaife collection, material loaned by SANC and the BMNH. Apart from variation in size, the external appearance of the specimens showed great similarity. All were collected in southern Africa and, where known, the host plant was always *Acacia erioloba*, the only anomaly being *C. interstinctus* from 'Caffraria.' This is taken to be the eastern coastal area of southern Africa. This in effect means that the area indicated by Fåhræus is greater than that previously accepted or, alternatively, the host for this species is not the same as the other two from southern Africa, as *Acacia erioloba* does not grow along the east coast area.

Examination of the male genitalia of these specimens indicated the presence of two or possibly three species. As far as it is possible to ascertain at present, the female genitalia available to us for study are identical, although there is slight variation of the shape of the vaginal plates and number of spines in the neck region of the bursa copulatrix (Figs. 69, 70, 71). The male genitalia on the other hand, when available, showed quite distinct differences. It is unfortunate that the types of *C. interstinctus* and *C. multinotatus* are females and unique. Thus, both are holotypes. During this study, we have associated males with both species and believe these associations to be correct.

Decelle (1958), Borowiec (1990a), and Southgate (1979) agree that *Caryedon interstinctus* is a

good species. The subspecies *Caryedon albonotatus* var. *multinotatus* (Pic) is also valid and was raised to species status by Van Tonder (1985). She gave no specific reason for this change. Borowiec (1990a) also recognized *C. multinotatus* as distinct from *C. albonotatus*, closely related to *C. interstinctus*, and again raised *C. multinotatus* to species status, based on the spines in the internal sac of the male genitalia that were only one-half as long as those of *C. interstinctus*. Borowiec indicated that *C. multinotatus* occurred only in Namibia. The male genitalia of *C. albonotatus* (Figs. 28, 147) have four large spines in the internal sac rather than the single, large, forked spine of the other three species. Van Tonder (1985) indicated that the species that Skaife (1926) referred to as *C. interstinctus* was a misidentification by Skaife and the species that he actually studied was *C. multinotatus*. To Pic's type locality of *C. multinotatus* are added specimens from the following localities: Transvaal, Botswana (Bechuanaland) and S.W. Africa (Namibia). An undescribed species, externally very similar to the two previously mentioned species, was found among the material examined and is described here as *Caryedon decellei*.

Pic (1913) listed North Africa as the type locality where *C. albonotatus* was collected. However, in the original description, Pic (1898b) gave the locality as Natal. Natal is in agreement with the data label on the paratype in the Pic collection (the holotype appears to be lost).

From our present knowledge, *C. albonotatus* is the most widespread of the four species within this complex as it occurs in west, east, central and southern Africa, with an isolated record from Ethiopia. In addition, it is able to utilize other hosts such as *Acacia nilotica* and *A. sieberiana*; both are widespread on the African continent.

Caryedon johni Borowiec

Figs. 72–76

Caryedon johni Borowiec 1990b: 60 (Holotype: Madagascar; ZMB).

Description.—Paraphrased from Borowiec (1990b). *General facies*: Very similar to *C. serratus* and other members of the *Serratus* Group. Length (pronotum—elytra) 5.2–6.3 mm. Width 2.8–3.3 mm.

Male. *Integument color*: Head, body and appendages usually red brown; thorax, elytra and

hind femur with small black spots; antennal segments usually more or less infuscate.

Vestiture: Uniformly golden, dense, covering body surface.

Head: Moderate in length, copiously and densely punctate; frons narrow with sharp median carina; width of eye about twice width of frons; ocular sinus about 0.1 as long as eye; tempora as wide as ocular facet diameter; distance from base of antenna to apex of labrum about 0.5 distance from upper limit of eye to apex of labrum; antennal segments 1–4 filiform, 2 shorter than other segments, 5–6 about 1.5 times longer than wide, 7–10 about twice longer than wide, 11 about 2.8 times longer than wide; antenna reaching to 0.33 elytra length.

Pronotum: Disk pentagonal, about 1.4 times wider than long, depressed above with moderately dense punctation, distance between punctures usually equal to puncture diameter but sometimes punctures grouping in 2–4; space between punctures with moderately dense, small secondary punctation; lateral prothoracic carina extending from base to about 0.7 distance to apex of pronotum; prosternum separating procoxae for about 0.3 their length.

Scutellum: Small, rounded apically.

Mesothorax and Metathorax: Elytron 2.9–3.1 times longer than wide; striae moderately impressed, punctuate, striae intervals smooth, striae 3 and 4, and 6 and 7 closer to one another at base than to adjacent striae; striae 4 and 5 shortened and closed posterad; hind coxa smooth; hind femur strongly incrassate, about 1.8–1.9 times longer than wide, prepectenar ridge slightly serrate, pecten with 11–13 spines, spine 1 largest, remainder gradually smaller; hind tibia strongly arcuate with sharp ventral, lateroventral and lateral longitudinal carinae; mucro about as long as width of tibial apex and about 0.25 times as long as tarsomere 1 (Fig. 72).

Abdomen: Sterna not flattened medially; sternum 1 about 0.6 times as long as abdomen, posterior margin straight; sterna 2–4 unmodified, sternum 5 emarginate to 0.33 length; pygidium punctulate, moderately convex in lateral view.

Male genitalia: (Fig. 73). Median lobe elongate, broad, ventral valve with deeply concave lateral margins, narrowing to acuminate apex; dorsal valve elongate with concave lateral margins, narrowing to slightly obtuse apex; armature of internal sac with four pairs of large sclerites: two

hook-like pairs near middle, basal pair only slightly smaller than more apical pair, pair of saber-shaped and pair of stick-shaped, curved sclerites near apex; groups of spinules present in internal sac.

Female. Similar to male except abdominal sternum 5 not emarginate at apex.

Female genitalia: (Figs. 74, 75, 76). Sclerites of ovipositor extremely long, the longest in the genus (Fig. 74); spiculum ventrale elongate (Fig. 75); vaginal sclerite large, about two times longer than wide (Fig. 76).

Host Plants.—Unknown.

Distribution.—Madagascar.

Discussion.—*Caryedon johnei* is in the *Serratus* Group. See *C. serratus* for a discussion of *C. johnei* and other members of Subgroup 3.

Caryedon kivuensis Decelle

Figs. 77, 78

Caryedon kivuensis Decelle 1951: 190 (Holotype: Congo Belge: Mulungu; MRAC); Decelle 1960a: 72; Udayagiri & Wadhi 1989: 230; Borowiec 1990a: 386.

Description.—*General facies*: More elongate than most species of *Caryedon*; characterized by its unique coloration of body entirely reddish-ferruginous, with eyes and antennae black except the upper side of the first three antennal segments; legs pale with hind femur sometimes brown. Length 5.0–6.0 mm.

Head: Reddish-ferruginous; with sparse silver setae; median carina present, more prominent apically, surface on either side of carina confusedly punctate, punctures of irregular size; width between eyes varying from 0.5 length to slightly more than length of antennal segment 2, surface covered with fine golden pubescence; eyes black, prominent with large facets; head strongly constricted at base of eyes, punctures less evident; antennal segments 1–4 rounded, testaceous, segments 5–11 serrate to subserrate, piceous.

Pronotum: Transverse, integument fuscous to fusco-testaceous, lateral margins with basal 0.66 straight or at most slightly arcuate, apical 0.33 acutely conical; surface punctate; overlaid with fine silver to golden setae, integument clearly visible through setae.

Scutellum: Slightly longer than broad, acuminate, covered with long white pubescence.

Meso- and Metathorax: Elytra 0.33 to 0.5 longer

than broad, apices rounded, striate, striae with deep well-defined punctures; integument reddish-ferruginous; pubescence of very fine silver or golden setae, integument clearly visible through setae; legs pale, hind leg sometimes brown; hind femur with prepectenar ridge varying from smooth to several small denticles present.

Pygidium: Longer than broad, male with broadly rounded apex and lateral margins slightly arcuate, female slightly more pointed at apex with lateral margins less arcuate; surface of male pygidium more or less flat except extreme apex curved under, female flat at extreme apex but with slight medial hump about 0.33 length from apex in longitudinal axis; integument overall reddish-ferruginous, males covered with long golden pubescence, females covered with long silver to golden pubescence.

Male genitalia: (Figs. 77, 78). Median lobe short and broad; ventral valve broad at base, very narrow because lateral margins deeply concave, apex acuminate, dorsal valve with lateral margins convex, gently curving to acuminate apex; armature of internal sac with 12 spines arranged as follows: group of spines extending from base to middle, from base group consists of two largest curved spines broadened at their base with two much smaller spines near base of large spines, followed by pair of curved spines, two pairs of straight spines and one pair of curved spines apically, spines arranged in succession apically from large spines; entrance to ejaculatory duct campanulate, covered with small spines, behind this an area, separated from main pair covered with small spines (Figs. 77, 78).

Female genitalia: Unknown.

Host Plants.—Unknown.

Distribution.—Zaire (now Democratic Republic of the Congo), Rwanda (Decelle 1951: 189; Udayagiri & Wadhi 1989: 230). Ghana, Zambia (Borowiec 1990a: 386).

Discussion.—*Caryedon kivuensis* is in the *Acaciae* Group. See *C. acaciae* for a discussion of this species and other members of Subgroup 5.

Caryedon kivuensis, *C. cassiae*, *C. crampeli*, and *C. congensis* are all closely related. Delobel and Johnson studied the male genitalia of all four species and found them to be distinctly different, distinct enough to merit species status for the four.

Caryedon longipennis (Pic)

Figs. 79, 155

Caryoborus longipennis Pic 1898a: 174 (Holotype ♂, Haut-Soudan; MNHN).

Pachymerus longipennis: Pic 1913: 8.

Caryedon longipennis: Decelle 1960a: 72, 1966: 172; Prevett 1971: 258; Pfaffenberger 1985: 1; Udayagiri & Wadhi 1989: 231; Delobel *et al.* 1995b: 81; Silvain & Delobel 1998: 534.

C. combreti Prevett 1965: 533 (Holotype ♂: Katsina Province, Kabakawa Forest Reserve near Katsina, Nigeria; BMNH); Decelle 1966: 172.

Description:—*General facies*: Integument fuscous overlaid with pale fawn pubescence. Length 4.1–6.8 mm. Width 2.3–3.3 mm.

Head: With integument fuscous, becoming darker towards clypeus; pubescence pale fawn, thickly deposited, almost obscuring integument; short median carina present but not prominent, almost wholly obscured by pubescence, basally median carina becomes no more than a glabrous line and in some specimens is even slightly impressed; eyes of normal size with small facets; eyes set widely apart, width equal to length of antennal segment 2.

Pronotum: Subquadrate, with slightly over 0.66 of lateral margins straight, remainder conical; integument fuscous, with shallow punctures scattered over surface; pubescence of fawn setae covering integument almost completely.

Scutellum: Elongate, narrow, covered with fawn setae.

Meso- and Metathorax: Elytron longer than broad, apices very slightly truncate, very slight depression at bases of striae 5 and 6, resulting in a more pronounced humeral callosity; integument of holotype fuscous without any maculations, some examples have very small maculate areas scattered over the greater part of the elytra, these end in a lateral band of darker integument approximately 0.33 from apex overlaid with dark pubescence, width and extent of band vary considerably from specimen to specimen; examples from the Sudan in *Combretum hartmannianum* have very strongly maculate elytra, with the apex covered with white pubescence; pubescence fawn and almost completely covering integument; legs testaceous to fuscous, hind femur with very small areas of darker integument with corresponding dark pubescence in some males otherwise com-

pletely immaculate; prepectenar ridge of hind femur with several very small, well-defined spines.

Pygidium: Male with lateral margins arcuate and apices truncate, female with lateral margins arcuate and evenly rounded apex; integument fuscous with varying amounts of darker fuscous, in male there may be three longitudinal dark stripes, black pubescence overlying dark integument, remainder of pubescence fawn; female with dark areas of integument on fuscous integument but not clearly defined; pubescence also mostly fawn with smaller areas of dark overlying dark integument.

Male genitalia: (Fig. 79). Ventral valve with straight lateral margins narrowing toward gently blunt apex, dorsal valve broad, with convex lateral margins; armature of internal sac with 8 spines as follows: near base two large, long, strongly curved spines, these superimposed upon two smaller spines, both pairs covered by small spines of decreasing size from base to apex, apical to these two pairs of spines, two long and thin and another approximately 0.5 the size of other two (Fig. 79); lateral lobes angular, broad, expanded at their apices, only slightly cleft medially at apex, with heavily sclerotized apical edges with many setae.

Female genitalia: (Fig. 155). Vaginal sclerites consist of two parts, first a rounded region that has two oval, thin, sclerotized plates, these extend to a second part that is almost triangular; this leads to neck region of bursa copulatrix which has a slightly more thickly sclerotized shield-shaped plate with a flat top; this area has the basal edge ornamented with a row of large, slender arrow-shaped spines, followed by a mass of very minute spines which gradually decrease until they merge into the bursa copulatrix proper that is unornamented; spiculum ventrale broadly arched, ending in short acuminate tail, shoulders extend to form elongate extensions ending in fine points.

Host Plants.—*Old records*: *Combretum ghasalense* (Udayagiri & Wadhi 1989: 231); *C. glutinosum* (Udayagiri & Wadhi 1989: 231; Delobel *et al.* 1995: 81); *C. hypopilinum* (Udayagiri & Wadhi 1989: 231); *C. lamprocarpum* (Udayagiri & Wadhi 1989: 231); *C. micranthum* (Udayagiri & Wadhi 1989: 231; Delobel *et al.* 1995: 81); *C. molle* (Udayagiri & Wadhi 1989: 231).

New records: *Combretum hartmannianum*: Sudan: Nuba Hills. *Combretum cordofanum*: Sudan:

Bahr el Arab? sp.?, 10° 08'N, 25°02'E, 22/4/1971, collected by G. E. Wickers.

Distribution.—Sudan, Nigeria, Belgian Congo (Decelle 1960a: 72). Senegal (Delobel *et al.* 1995b: 81; Silvain & Delobel 1998: 534). Sudan (BJS).

Discussion.—*Caryedon longipennis* is in the *Longipennis* Group. Pic (1898a) described *C. longipennis* from the Sudan with notes on its distinguishing features from what he assumed to be a geographically related species near *C. pallidus*. Under *C. pallidus*, we show that it is not the species found commonly in the Sudan (Nile Basin) region, *C. sudanensis*. Prevett (1965) described a number of new species of *Caryedon* from Combretaceae from Nigeria, one of which he named *C. combreti*. Decelle (1966) discussed the type species of *Caryedon* and synonymized *C. combreti* Prevett with its synonym, *C. longipennis* Pic. Decelle incorrectly cited Pic's original description of *C. longipennis* to the "Bull. Soc. Ent. Fr. 23, p. 174". This should have read "Bull. Soc. Zool. Fr. 23, p. 174".

Most samples of *C. longipennis* have very small maculate areas scattered over the elytra (Fig. 141). The integument of the elytron of *C. longipennis*, however, is occasionally without maculations. The maculations end in a lateral band of darker integument approximately one-third from the apex. The width and extent of this band vary considerably from specimen to specimen. Mr. Airy-Shaw of the Royal Botanic Gardens, Kew, gave specimens of *C. longipennis* reared from seeds of *Combretum hartmannianum* from the Sudan to BJS. These examples differ considerably from the type in external characters (they have very strongly maculate elytra) but agree in characters of the genitalia. These differ from the other three species in the group in that there is no apparent pattern of maculations. *Caryedon atrohumeralis* and *C. lunatus* share an oblique band on the elytron that extends toward the apex of the elytron and the internal sac of the male genitalia has eight or more spines. The elytral band of *C. lunatus* differs, however, in that the elytral band does not extend to the lateral margins of the elytra. However, in *C. atrohumeralis*, the band extends to the lateral margins from the base almost to the middle. *Caryedon elongatus* differs from the other three species primarily in the structure and color of the elytra. Its elytron is much longer than broad. The elytron is testaceous, except for black maculations covering

interstices 7–8 and 9 and extending from the humerus apically for approximately one-half the length of elytron. It also has a narrow, black, transverse band across the apical one-third of the elytron.

Caryedon longus (Pic)

Fig. 80

Caryoborus longus Pic 1902c: 146 (Syntypes: Afrique australe; MNHN).

Pachymerus longus: Pic 1913: 8; Peake 1952: 318; Zacher 1952: 469; Lukianovich & Ter-Minasian 1957: 35; Davey 1958: 387.

Caryedon longus: Decelle 1956: 426, 1970: 257, 1975: 24; Davey 1958: 385; Prevett 1965: 526; Smith & Brower 1974: 323; Udayagiri & Wadhi 1989: 231.

Description.—*General facies*: Integument fusco-testaceous with some small areas of maculations; pubescence coarse golden. Length 4.4–5.5 mm. Width 2.0–2.5 mm.

Head: Median carina scarcely visible; integument fusco-testaceous overlaid with golden to fawn pubescence; eyes set widely apart, with coarse facets, antenna serrate, serrate segments as broad as long, wholly testaceous.

Pronotum: Transverse, integument rufous with maculations on disc and with basal and apical angles black; pubescence coarse golden setae.

Scutellum: As long as broad, covered with golden pubescence.

Meso- and Metathorax: Elytra longer than broad, integument fusco-testaceous with scattered maculations mainly along the lateral margins and with apical band of black; pubescence coarse golden or fawn setae; legs fuscous, same color as elytra; prepectenar ridge of hind femur with a few, indistinct serrations, pecten with large first spine followed by a number of smaller spines.

Pygidium: Male with lateral margins arcuate and apex evenly rounded; integument fusco-testaceous with 2 mediolateral dark areas; dark pubescence covering integument except for extreme base and apex.

Male genitalia: (Fig. 80). Median lobe short and broad; ventral valve with lateral margins concave, narrowing to obtuse apex; dorsal valve broader, lateral margins slightly convex, narrowing to gently rounded apex; armature of internal sac with 4 spines arranged as follows: base with pair of thick, curved spine-like processes with two small,

stout spines attached, apical to these a pair of thinner, longer almost straight spines with slightly expanded bases (Fig. 80); lateral lobes narrow, elongate, expanded at apices, apices rounded, with broad median cleft, apices with many elongate setae.

Female genitalia: Unknown.

Host Plants.—*Old records*: *Acacia arabica* (Peake 1952: 318; Udayagiri & Wadhi 1989: 231); *Arachis hypogaea* (Lukianovich & Ter-Minasian 1957: 35; Davey 1958: 389); *Faidherbia albida* (as *Acacia albida*; Peake 1952: 318; Udayagiri & Wadhi 1989: 231); *Prosopis africana* (Davey 1958: 387); *P. chilensis* (Davey 1958: 387); *P. juliflora* (Davey 1958: 387); *Prosopis africana* (Guill. & Perr.) Taub. (as *P. oblonga* Benth; Davey 1958: 387); *Tamarindus indica* (Davey 1958: 387).

New records: None.

Distribution.—Africa. Angola, South Africa, Tanzania, Transvaal (Decelle 1970: 257, 1975: 24)

Discussion.—*Caryedon longus* is in the *Serratus* Group. See discussion of *C. serratus* for a discussion of *C. longus* and other members of Subgroup 3.

Caryedon longus has been confused with *C. serratus*, the species that feeds in the groundnut (*Arachis hypogaea*). The male genitalia of *C. longus* (Fig. 80) are distinct from *C. serratus*. The only examples seen by BJS of this species are those in the Pic collection in the MNHN. Because the syntypes are merely labeled Africa, the distribution of *C. longus* is questionable except for Angola, South Africa, and Tanzania (Decelle 1970, 1975).

Prosopis africana (*oblonga*) is its only known host plant although Peake (1952) indicated that it is "on *Acacia albida* and occasionally on *A. arabica*."

Caryedon lunatus Prevett

Figs. 81, 141, 156

Caryedon lunatum Prevett 1965: 535 (Holotype ♀: Bauchi Province, Nr. Giade, N. Nigeria; BMNH); Prevett 1966: 13, 1967a: 5, 1971: 258; Pfaffenberger 1985: 1; Udayagiri & Wadhi 1989: 231; Silvain & Delobel 1998: 534.

Description.—*General facies*: Integument fuscous with a few maculations on thorax and base of elytra, apical 0.33 of elytra with broad crescent-shaped dark area; pubescence pale fawn covering integument fairly thickly. Length 4.7–5.4 mm. Width 2.4–2.5 mm.

Head: With integument fuscous, median carina present, basally it is a glabrous slightly impressed line; surface reticulate to micropunctate overlaid with pale pubescence, except over glabrous median line; eyes coarsely faceted, width between eyes fairly wide, equal to length of antennal segment 2 or nearly so; antennal segments 5–11 serrate, apical segment short, unevenly acuminate, testaceous or dark testaceous.

Pronotum: Subquadrate, apical 0.5 conical, basal 0.5 with lateral margins parallel; integument fuscous varying to some with vestigial lines of broken areas of maculations running longitudinally down medial region, surface confusedly punctate with large shallow punctures; pubescence of pale fawn, coarse setae.

Scutellum: Longer than broad; covered with white pubescence.

Meso- and Metathorax: Elytra together longer than broad, apices rounded or at most slightly obliquely truncate, integument fuscous with scattered small maculate areas predominantly along lateral margins; apical region with a broad black crescent-shaped band extending transversely across both elytra and reaching almost to the lateral margins; pubescence mostly pale fawn to white with darker setae over dark integument; legs 1 and 2 testaceous to fuscous with some maculations on femora and tibia, hind pair of same coloration as elytra, with variable amounts of maculations on hind femora; prepectenal ridge of hind femur serrate.

Pygidium: Broader than long in both sexes, lateral margins slightly arcuate with truncated apex, female with slight, medial notch at apex; integument fuscous to piceous with considerable variation in amount of each color, pubescence pale fawn to whitish over light integument, dark brown to black over dark integument, distinct, white, median line sometimes present.

Male genitalia: (Fig. 81). Median lobe short, broad; lateral margins of ventral valve concave, apex truncate, concave medially, lateral margins near apex concave; dorsal valve gently curved to acuminate apex; armature of internal sac with 8 spines arranged as follows: with clump of three pairs of spines at base, one pair of longer spines medially (Fig. 81); end of ejaculatory duct not ornamented and barely perceptible; lateral lobes narrow, elongate, slightly cleft medially, with elongate setae at apices.

Female genitalia: (Fig. 156). Vaginal sclerites

consist of two parallel sided thinly sclerotized plates with rounded ends joined to a central circular area with a more strongly sclerotized rim; neck of bursa copulatrix with armature of the same type as *C. immaculatus*, bursa copulatrix very slightly sclerotized and unadorned with spines.

Host Plants.—*Old records:* *Combretum hypopilinum*, *C. micranthum*, *C. molle* (all: Prevett 1965: 536, 1967a: 5; Udayagiri & Wadhi 1989: 231).

New records: None.

Distribution.—Nigeria, Senegal (Silvain & Delobel 1998: 534).

Discussion.—*Caryedon lunatus* is in the *Longipennis* Group. See discussion of *C. longipennis* for a discussion of this species.

Caryedon macropterae Delobel

Figs. 82–86

Caryedon macropterae Delobel 1997: 393 (Holotype ♀: Sénégal, Région de Fatick, 7 km N. de Missirah; MNHN); Silvain & Delobel 1998: 534.

Description.—This description is translated and paraphrased from Delobel (1997). Length 5.0–6.2 mm. Female. **Color:** Integument almost uniform brownish-red, only head appearing darker, almost red; all of body clothed with recumbent, dense, yellowish to gold pubescence.

Head: With well-marked interocular carina, acute on anterior 0.66, not continuing behind but in form of a rounded convexity, surface microreticulate; maximal distance between eyes: dorsally 0.41 times maximal width of eye, ventrally 1.21 times width of eye at narrowest where eyes are very near each other; antennal segments in ratio of: 1.5; 0.8; 1; 1; 1.6; 1.6; 1.6; 1.6; 1.7; 1.8; 2.2 (segment 4 being taken as a unit of length), enlarged apically beginning with segment 5.

Pronotum: In dorsal view (perpendicular to disk) measuring 1.5 mm long in holotype (1.4 mm on average; from 1.3 to 1.5 mm), 1.41 times wider than long at base, lateral margins concave at base and as far as anterior extremity of lateral carina; disk with large, deep, round punctations, in some areas, integument glossy, irregularly and superficially punctate; short, glabrous, longitudinal line at base.

Scutellum: With rounded apex.

Meso- and Metathorax: Elytra 2.9 times longer than pronotum, 1.39 times longer than the greatest width of elytra together; length at suture, mea-

sured perpendicular to disk: 4.5 mm (4.4 on average; from 4.0 to 4.7 mm); lateral margins expanded a little behind basal 0.33 of their length, then curved normally; with fine striae, deep, marked with punctations separated by 3 to 5 times their diameter; stria intervals microreticulate, in parallel furrows, principally at base; humeral callosities marked, surface of elytron slightly wavy behind; striae 2-3, 4-5, 6-7 near but not joined behind, stria 9 incomplete at same distance from base as 6-7, stria 10 incomplete at distance from base intermediate between striae 4-5 and 6-7; metathoracic femora strongly incrassate, suboval, medial surface flat to slightly convex, prepectenar ridge formed of 10 closely grouped, small spines, pecten with large spine followed by 12 smaller spines (varies from 12 to 14), metathoracic tibia with 5 well-marked, longitudinal carinae, mucro at apex.

Abdomen: Sternum one 0.63 times total length of abdomen, apex of last sternum sinuate; pygidium almost longer than wide at base, little curved longitudinally, bulging at center, emarginate at apex, with small concavity basal to emargination, apical margin with two lateral tufts of long, golden setae.

Female genitalia: (Figs. 82, 83, 84). With spiculum ventrale short, with an apodeme about 0.7 times length of remainder of sclerite (Fig. 82), sclerite heavily sclerotized, thick; sclerotized areas of tergum 9 (Fig. 83) with two central, feebly sclerotized structures, almost linear, subparallel, not joined at apex or base, their length is less than that of spiculum ventrale; vagina membranous, devoid of sclerites (Fig. 84), with a series of thick, very feebly sclerotized folds, particularly in front of junction with spermathecal canal, junction encircled by several folds; bursa copulatrix with 2 series of spicules: first series arranged into two vague plaques at entrance at its most narrow, second series V-shaped, more apical, almost in median portion (Fig. 84).

Male. Similar to female. Antennal segments slightly less elongate than female, with ratio: 1.4; 0.8; 0.8; 1; 1.5; 1.3; 1.4; 1.4; 1.4; 1.5; 2.1; pronotum in allotype 1.5 mm long (1.4 on average; from 1.3 to 1.6 mm), elytra 4.5 mm (4.1 on average; from 3.7 to 4.6 mm); apex of last abdominal sternum straight, not sinuate, pygidium more arched longitudinally than female, without central bulge or 2 lateral tufts of long, golden setae.

Male genitalia: (Figs. 85, 86). Median lobe short; ventral valve elongate, apex acuminate; internal

sac, when inflated, measuring almost 1.5 times length of median lobe; armature of 9 large, recurved spines as follows: from base to apex of sac two series of two spines ventrally and one series of five subapical, evenly spaced spines; internal sac clothed dorsally with microspinules grouped into 5 or more, ventrally with sclerotized, approximately rectangular or round microplaques (Fig. 85), subapical zone on ventral surface with patch of short hairs; lateral lobes short, completely fused, scarcely cleft at apex (Fig. 86), with many elongate setae at apices; base of lateral lobes with large dorsal apodeme and a smaller, ventral apodeme.

Host Plants.—*Old records:* *Terminalia macroptera* (Delobel 1997: 391).

New records: None.

Distribution.—Senegal.

Discussion.—*Caryedon macropterae* is in the *Acaciae* Group. See *C. acaciae* for a discussion of this species.

***Caryedon maculatus* Johnson, Southgate & Delobel,
new species**

Fig. 158

Description.—*General facies:* Integument fuscous to mottled fusco-piceous; pubescence fuscous overlying integument. Length 4.4 mm. Width 2.4 mm.

Head: Fuscous, sparsely covered with silvery pubescence; median carina well defined, extending beyond anterior margin of eyes, width between eyes narrow at apical margin, approximately equal to length of antennal segment 2; eyes coarsely faceted; antenna wholly fuscous, segments 1-4 rounded, segment 1 twice as long as 2, segments 5-10 serrate, segment 11 sharply but unevenly acuminate.

Pronotum: Transverse, basal 0.66 of lateral margins straight, apical 0.33 conical; integument fuscous with unevenly spaced shallow punctures; pubescence fawn, almost completely covering integument.

Scutellum: Longer than broad, slightly bifid at apex, covered with fine, short white pubescence.

Meso- and Metathorax: Elytra hardly longer than broad, apices rounded, integument fuscous with large areas of black maculations concentrated in apical 0.33 of elytra and along sutural line; pubescence fawn over fuscous integument, darker over black integument, that gives a mottled ef-

fect to elytra; legs fuscous with hind femur and tibia slightly darker; prepectenar ridge of hind femur with few small serrations.

Pygidium: Longer than broad, lateral margins straight, apex evenly rounded; integument fuscous in sutural and apical regions, basally two dark areas on either side of midline; pubescence composed of fine golden setae over fuscous integument with dark setae over dark integument.

Male genitalia: (Fig. 158). Median lobe short and broad; ventral valve broad at base, lateral margins sclerotized, concave, narrowing to elongate acuminate apex; dorsal valve with lateral margins straight, apex gently rounded; armature of internal sac with 7 spines arranged as follows: a mass of small spines near base, apical to these two large hook-shaped structures with thickened bases broadened basally with a single small spine on each, near apex a group of smaller spines consisting of a pair of long, thin, pointed spines, a smaller pair and a single longer curved structure, all in a mass of small spines; lateral lobes narrow, elongate, expanded at apices, sclerotized, with moderate medial cleft, with many elongate spines at apices.

Female genitalia: Unknown.

Host Plants.—Unknown.

Type series.—Holotype ♂: SUDAN: Sharta, W. Halfa distr., 7.4.1964, M. Meinander. Holotype deposited in the UZMH.

Distribution.—Sudan.

Etymology.—This species is named for the maculations on the body.

Discussion.—*Caryedon maculatus* is in the *Serratus* Group. See *C. serratus* for a diagnosis of *C. maculatus* and discussion other members of Subgroup 3.

This is another species from the 1962 Finnish expedition to Sudan and Ethiopia. Only a single example has so far been recorded for this species.

Caryedon maculipes (Pic)

Figs. 87, 157

Caryoborus maculipes Pic 1911: 124 (Holotype: Afrique orientale; MNHN).

Pachymerus maculipes: Pic 1913: 8; Zacher 1952: 469.

Caryedon maculipes: Decelle 1951: 188, 1958: 83, 1960b: 142, 1970: 257; Zampetti 1988: 107; Udayagiri & Wadhi 1989: 231; Borowiec 1990a: 387.

Description.—*General facies*: Integument fusco-

rufous; sparsely overlaid with long silver-gold pubescence. Length 4.5–5.0 mm. Width 2.6 mm.

Head: With integument dark fuscous between eyes and at base, becoming lighter toward clypeus, area around insertion of antenna darker along edge of ridge; median carina narrow, prominent, cuticle on either side punctate, overlaid with very fine setae; eyes prominent but not excessively so, facets of average size; antennal segments 2–4 yellowish varying to 1–4 and extreme base of 5 pale testaceous, segment 1 twice as long as 2, segments 2–4 about same size; remaining segments serrate, each segment slightly longer than broad; segment 11 evenly acuminate, slightly lighter color at apex.

Pronotum: With integument fuscous with dark rim at apex; surface punctate with large unevenly spaced punctures; pubescence sparse silver; lateral margins with apical 0.5 acutely conical, basal 0.5 slightly arcuate.

Scutellum: Covered with long white pubescence.

Meso- and Metathorax: Elytra together slightly longer than broad, apices rounded; striate, striae 4 and 5 end approximately 0.33 from apex and do not converge as in most species; integument fusco-rufous; pubescence of long silver to golden setae; legs 1 and 2 testaceous, hind pair fusco-rufous, with darker areas at apex of femora and along tibial ridges; pecten of hind femur with first spine slightly larger than apical 12 denticles.

Pygidium: Longer than broad, lateral margins slightly arcuate, apex rounded; integument testaceous at base and lateral margins, central area very dark; pygidium overlaid with silver pubescence.

Male genitalia: (Fig. 87). Median lobe short and broad; ventral valve very short, with very broad base, lateral margins concave, apex acuminate, dorsal valve narrower and elongate with convex lateral margins, apex acuminate; armature of internal sac with 12 spines as follows: spines extending from base to apex with large pair of curved spines near base, pair of very small spines lateral to large spines, pair of moderately long curved spines apical to large pair, clump of 3 pairs of spines near apex consisting of a pair of small curved spines medially, a pair of thin, elongate spines with broadened bases slightly lateral to these and pair of smaller, sinuate spines laterally.

Female genitalia: (Fig. 157). Vaginal sclerites consist of two large, thinly sclerotized, overlap-

ping, oval plates; apical end with twin oval areas that are more strongly sclerotized; below vaginal sclerites a broad neck region ornamented with usual-shaped, spine-like structures with points at both ends; bursa copulatrix ornamented with a large number of feebly sclerotized, small spines.

Host Plants.—*Old records:* *Cassia* sp. (Udayagiri & Wadhi, 1989: 232).

New records: *Senna occidentalis*: People's Republic of Congo: Brazzaville, April 1984.

Distribution.—Afrique orientale. Eritrea, Angola, Tanzania, Uganda, Rwanda, Burundi, Zimbabwe, South Africa (Decelle 1970: 257; Zampetti 1988: 107; Borowiec 1990a: 387). Zaïre (now Democratic Republic of the Congo) (Decelle 1951: 188).

Discussion.—*Caryedon maculipes* is in the *Acaciae* Group. See *C. acaciae* for a discussion of this species and other members of Subgroup 5.

Pic (1913) gave the locality for this species as Südafrika. The location of the habitat given on the label attached to the type specimen gives "or Shirati" which is on the shores of Lake Victoria in Tanzania.

Caryedon mauritanicus Decelle, *nomen nudum*

Caryedon mauritanicus Decelle 1979a: 328. *Nomen nudum*.

Decelle (1979a: 328) referred to the name *Caryedon mauritanicus* Decelle as being published in a paper by Decelle (1979, "Rev. Zool. Afr., sous presse"). He (1979a) noted specimens from Mauritania, Senegal, Mali, and Sudan, but no description was given. Unfortunately the "in press" paper was never published. However, several authors have referred to this as valid a name, but it is actually a *nomen nudum*. Anton (1994a) and Silvain & Delobel (1998) correctly noted this as a *nomen nudum*.

Caryedon meinanderi Johnson, Southgate & Delobel,
new species

Fig. 88

Description.—*General facies:* Integument fusco-testaceous overlaid with coarse white pubescence, some maculate areas over elytra, mainly apical 0.5. Length 4.4–4.5 mm. Width 1.9–2.1 mm.

Head: Fusco-testaceous; median carina prominent apically and blending basally into cuticle, surface on either side rugose to punctate, eyes

coarsely faceted and narrowly spaced but width between them slightly more than length of antennal segment 2; antennal segment 1 twice as long as segment 2, segments 5–10 serrate, almost as long as broad, segment 11 short, ovoid, unevenly acuminate.

Pronotum: Transverse, lateral margins straight for basal 0.66, apical 0.33 acutely conical; integument fusco-testaceous with slightly dark maculate areas on either side of medial line, surface covered with large punctures; overlaid with coarse white setae.

Scutellum: Triangular, covered with white pubescence.

Meso- and Metathorax: Elytra together longer than broad; apices slightly truncated; integument fusco-testaceous with maculate areas of varying size over surface, mainly apical 0.5; pubescence coarse white with some dark setae over dark integument; legs 1 and 2 testaceous, hind pair fuscous; prepectal ridge of hind femur with few small serrations.

Pygidium: Male with lateral margins straight, parallel, apex rounded, longer than broad; integument dark at base, fuscous from about 0.33 of distance from base to apex, pubescence dark over dark integument and golden over fuscous integument; female with lateral margins straight, broader at base, narrowing towards rounded apex, integument dark at base, covering almost 0.5 of pygidium, apical 0.5 fuscous; pubescence dark over dark integument intermixed with a few golden setae; basal 0.5 with long golden pubescence completely covering integument.

Male genitalia: (Fig. 88). Median lobe short and broad; ventral valve broad at base, lateral margins concave, narrow for most of its length, rounded at apex; dorsal valve with lateral margins slightly convex, acuminate at apex; armature of internal sac with 8 spines arranged as follows: with dense patch of spinules near base, with two pairs of large spines strongly curved at tip with broadened bases near midline, apical to these two pairs of spines with strongly recurved basal ends, more basal of two pairs shorter and thicker (Fig. 88); entrance to ejaculatory duct almost parallel sided and slightly ornamented with small spines except for apical region; lateral lobes with V-shaped medial cleft, angulate extremities and large, elongate setae on apices.

Female genitalia: Unknown.

Host Plants.—Unknown.

Type series.—Holotype ♂: SUDAN: Sharta, W. Halfa distr., 31.3.1964, M. Meinander; 1 paratype ♀: SUDAN: Wadi Halfa, 10.4.1964, M. Meinander. Holotype and paratype deposited in the UZMH.

Distribution.—Sudan.

Etymology.—This species is named in honor of its collector, Dr. Meinander.

Discussion.—*Caryedon meinanderi* is in the *Serratus* Group. See *C. serratus* for a diagnosis of *C. meinanderi* and discussion of other members of Subgroup 3.

Caryedon meinanderi differs from other *Caryedon* because of its distinctive male genitalia (Fig. 88). The species here described forms part of the material collected by the Finnish expedition to Sudan, Ethiopia and Aden in 1962.

***Caryedon mesra* Johnson, Southgate & Delobel,
new species**
Figs. 89–91

Description.—*General facies*: Integument fusco-rufous overlaid with coarse golden pubescence. Length 3.5–5.0 mm. Width 1.9–2.5 mm.

Head: With integument fusco-rufous; median carina present but not prominent; pubescence of fine golden setae; distance between eyes slightly more than length of antennal segment 2, facets small; antenna with segments 1–4 rounded, 5–10 serrate, serrate segments twice as long as broad, apical segment long, unevenly acuminate, antenna fusco-testaceous.

Pronotum: Transverse, basal 0.66 of lateral margins straight, apical 0.33 conical; integument fusco-rufous; surface covered with large shallow punctures, pubescence coarse, golden, not thickly deposited.

Scutellum: Longer than broad, integument darker than surrounding area, pubescence coarse, golden setae.

Meso- and Metathorax: Elytra together longer than broad, apices rounded; integument fusco-rufous to fusco-testaceous; pubescence sparsely distributed coarse, pale, golden setae; 1st and 2nd legs fusco-testaceous to fusco-rufous, hind leg fusco-rufous; pecten of hind femur with small first spine and 9 denticles, prepectenal ridge with few, small serrations.

Pygidium: Longer than broad in male with lateral margins slightly arcuate, apex slightly truncated; integument fusco-testaceous overlaid

with pale, golden pubescence; female with pygidium as long as broad, lateral margins almost straight, apex narrow and evenly rounded, integument fusco-testaceous with pale, golden pubescence.

Male genitalia: (Fig. 89). Median lobe short and broad; ventral valve sclerotized, very narrow with broad base and strongly concave lateral margins, apex acuminate, dorsal valve broad with convex lateral margins and acuminate apex; armature of internal sac with 6 spines arranged as follows: with two large hooked spines within medial mass of small spines, apical to these a pair of thin, straight spines with sharp points at basal ends, and a pair of thin, U-shaped spines near apex (Fig. 89); lateral lobes strongly sclerotized, narrow, elongate, broadened at apices, with well developed medial cleft, apices with many sturdy, elongate setae.

Female genitalia: (Figs. 90, 91). Ovipositor lobes and spiculum ventrale as in figures 90, 91; without characteristically developed vaginal sclerites and without armature of either neck region or bursa copulatrix.

Host Plants.—*Ferula communis*. Same data as types.

Type Series.—Holotype ♂, 1 ♂ and 6 paratype ♀♀: PALESTINE: Mesra, c-1.V. 1950, Bylinski-Solz, in seeds of *Ferula communis*. Holotype and three paratypes deposited in the BMNH. Four paratypes deposited in the collection of the Ministry of Agriculture, Department of Plant Protection, Jaffa, Israel.

Distribution.—Israel.

Etymology.—The specific epithet *mesra* is a noun in apposition to *Caryedon*.

Discussion.—*Caryedon mesra* is in the *Acaciae* Group. See *C. acaciae* for a diagnosis and discussion of this species, and other members of Subgroup 6.

Larvae of *Caryedon cyprus* and *C. mesra* may feed in seeds of the Apiaceae. Larvae of *C. mesra* have ostensibly been reared from seeds of *Ferula communis*. Despite several efforts by entomologists in Israel, *C. mesra* has not been found feeding in seeds of *Ferula communis* except on one occasion, even at its type locality. Therefore, this record needs to be verified. *Caryedon cyprus*, a species closely related to *C. mesra*, has been found in flower heads of a species of Apiaceae, so its larvae may feed in seeds of an umbelliferous species. *Caryedon germari* has reliably been report-

ed to feed in seeds of *Lisaea heterocarpa* (Apiaceae).

***Caryedon multinotatus* (Pic)**

Figs. 92, 144, 159

Pachymerus albonotatus v. nov. *multinotatus* Pic 1935: 12 (Syntypes: S. W. Africa; MNHN).

Caryedon albonotatum v. *multinotatus*: Udayagiri & Wadhi 1989: 228.

Caryedon multinotatus: Van Tonder 1985: 146; Borowiec 1990a: 387.

Length 6.2–8.2 mm. Width 3.1–4.5 mm.

Description.—*General facies*: Large species 6.2–8.2 mm. long, 3.1–4.5 mm. wide. Integument of mixed fuscous and piceous areas in varying proportions, overlying pubescence, mixed black and white, with pronounced pattern. Length 6.2–8.2 mm. Width 3.1–4.5 mm.

Head: Integument fuscous to piceous with sparse covering of white setae; rest of head indistinguishable from other species.

Pronotum: Transverse; integument fuscous with a black median area which widens gradually towards the basal edge or with a broken area of black bands with two or three complete ones or two outer complete and the central one only partially so; lateral margins also flanked with black for apical 0.33 with gradual tapering off toward basal angle; pubescence silver to white overall.

Scutellum: As long as broad and slightly bifid, covered with white pubescence.

Meso- and Metathorax: Elytra slightly longer than broad; apices of elytra slightly truncated; integument mostly fuscous with areas of black maculations that form a rather irregular pattern along sutural line and scattered randomly over the remainder of elytra with a tendency towards concentrations in the basal and apical areas; pubescence white over fuscous integument and dark fuscous to black over piceous integument; legs with maculations on a fuscous base, overlaid with complementary colored setae; hind femur with broad black median band and other smaller maculations, prepectenar ridge with a large number of serrations, pecten with large first spine followed by about 8 smaller spines 0.5 as long as first spine.

Pygidium: As broad as long; with black integument in basal and baso-lateral regions and fuscous area towards apex in the central regions, the amount of black to fuscous varies considerably;

pubescence black over black integument and of mixed white and brown setae over fuscous integument; apical edge of female pygidium with pronounced medial notch and a rounded tubercle medially situated near apical margin, tubercle more pronounced than in the other species of the group.

Male genitalia: (Fig. 92). Median lobe short, broad, ventral valve with lateral margins convex, gradually narrowing to blunt apex; dorsal valve narrower, lateral margins convex, gradually narrowing to rounded apex; armature of internal sac with two strongly sclerotized spines elongated to about 0.5 length of internal sac, spines spatulate and joined at their bases (Fig. 92); no ornamentation of the ejaculatory duct; lateral lobes elongate, narrow, broad at apices, with slight medial cleft, lobes broadly rounded at apices, with many fine setae.

Female genitalia: (Fig. 159). Spiculum ventrale and ovipositor lobes strongly sclerotized and comparatively short, each conforms to basic pattern of straight ovipositor lobes with a common spatulate base; spiculum ventrale approximately equal in length from apex of arched lateral margins, which are broadly thickened, to base of arch and from this point to a narrow base; vaginal sclerites extremely thin, consisting of 2 lightly sclerotized plates; neck of bursa copulatrix extends basally from this region armed with strong spines of varying sizes; bursa copulatrix not ornamented.

Host Plants.—*Old records*: *Acacia erioloba* (Van Tonder 1985: 147).

New records: *Acacia giraffae* (now *A. erioloba*) Windhoek, S.W. Africa, 22-1-33.

Distribution.—S. W. Africa. South Africa (Van Tonder 1985: 146). Namibia (Borowiec 1990a: 387). Transvaal, Botswana (BJS).

Discussion.—*Caryedon multinotatus* is in the *Interstinctus* Group. See discussion of *C. interstinctus* for a discussion of this species.

***Caryedon nigrinus* Johnson, Southgate & Delobel, new species**

Figs. 93, 160

Description.—*General facies*: Integument fusco-testaceous to piceous, thickly overlaid with silver pubescence almost obscuring integument. Length 5.3–6.0 mm. Width 2.5–3.0 mm.

Head: With prominent median carina almost

filling space between eyes, width between eyes at narrowest point less than length of antennal segment 2; eyes prominent with medium-sized facets; integument in dark specimens uniform piceous except for clypeal region dark testaceous; pubescence appears finer along sides of median carina, becoming coarser towards base of head and on clypeus; antenna testaceous to fuscous, segments 1–4 rounded, segment 1 twice as long as 2, segments 5–10 serrate, longer than broad, segment 11 long, unevenly acuminate, approximately 0.33 longer than segment 10.

Pronotum: Transverse, basal 0.66 of lateral margins straight or at most very slightly arcuate, apical 0.33 obliquely conical; integument fuscous to piceous; surface punctate with large irregularly spaced punctures; overlaid with coarse silver pubescence which almost obscures integument.

Scutellum: Slightly longer than broad, covered with silver pubescence.

Meso- and Metathorax: Elytra together longer than broad, apices slightly rounded to slightly truncate; striae well defined with large, contiguous punctures, punctures particularly well defined in dark examples; integument fusco-testaceous to piceous; pubescence silver and fairly coarse but short and very regularly spaced; legs 1 and 2 fuscous, with hind femora slightly darker, also darker on examples with dark integument on rest of insect, prepectenar ridge of hind femur with vestigial serrations.

Pygidium: In male slightly broader and lateral margins more arcuate than female, female with lateral margins almost straight with apex more acutely rounded; integument fuscous to piceous but with a gradual lightening of integument in all examples toward apex; pubescence long, thick, whitish to golden obscuring integument of pygidium.

Male genitalia: (Fig. 93). Median lobe short and broad; ventral valve strongly sclerotized, base narrow, lateral margins concave, apex acuminate, dorsal valve broad at base, lateral margins convex, apex acuminate; armature of internal sac with 7 spines as follows: medially a complex array of spines and hooks, consisting of two main double-pronged spines broadened at base, apical to these a pair of long, narrow, recurved spines with somewhat broadened ends, medial to these a pair of elongate, thin, curved spines, laterally one narrow spine with broad base and pointed end, conglomeration of very small spines surrounding

and obscuring parts of major armature; ejaculatory duct ends in campanulate structure thickened along its outer edges and covered with minute spines (Fig. 93); lateral lobes elongate, apices broad, slightly rounded, with slight medial cleft, many elongate setae on apices.

Female genitalia: (Fig. 160). Vaginal sclerites of two oval plates ornamented at apical end by series of rounded excrescences, covering inner 0.5 of each plate is a further thin sclerotized plate with upper edge strongly sclerotized that extends beyond apical margin to end in pair of small sclerotized structures, area immediately above apical margin of plates covered with minute spines; neck region of bursa copulatrix with four sclerotized, small, oval plates with spines on one side and below these and extending onto bursa copulatrix proper covered with long, arrow-shaped spines.

Host Plants.—Unknown.

Type series.—Holotype ♂: SUDAN: Equatoria, Juba, 27, 2–2.3. 1963. Linnavuori. 3 paratypes: SUDAN: Sudan Nile, Blue Nile, Singa-Roseiras, 15–17.11.1962, Linnavuori; Sudan Kordofan, El Obeid, 29.1.1963, Linnavuori; ERITHREA: Dogali-Ailet, 26.5.1965, Linnavuori. Holotype and one paratype deposited in the UZMH. Two paratypes deposited in the BMNH.

Distribution.—Sudan, Eritrea.

Etymology.—The specific epithet *nigrinus* refers to the coloration of this species.

Discussion.—*Caryedon nigrinus* is in the *Acaciae* Group, subgroup 4. See *C. acaciae* for a diagnosis and discussion of this species. The armature of the internal sac is unique to this species.

Examples of this species form part of a large series of *Caryedontini* collected by a Finnish expedition to Sudan, Ethiopia and W. Aden in 1962–1963. The material has full data regarding locality, altitude etc., but no data on host plants.

Caryedon nigrosignatus (Pic)

Fig. 94

Caryoborus nigrosignatus Pic, 1902b: 5 (Syntypes: Rhodésia; MNHN); Pic 1932: 5.

Pachymerus nigrosignatus: Pic 1913: 8.

Caryedon nigrosignatus: Decelle 1970: 257; Udayagiri & Wadhi 1989: 232; Borowiec 1990a: 387.

Pachymerus atricolor Pic 1924b: 457 (Holotype: Congo da Lemba; MRAC). **New synonymy.**

Caryedon atricolor: Decelle 1951: 188; Udayagiri & Wadhi 1989: 228.

Description.—*General facies:* Very small species, pitchy head and thorax, fuscous and black elytra, with sparse silvery pubescence. Length 4.5 mm. Width 2 mm.

Head: Very broad, surface punctate, without pubescence on pitchy integument; without median carina or at the most a very slight line present; eyes set very widely apart; distance between eyes slightly less than length of antennal segment 1, eyes set well into head and barely protruding, facets fine; antennal segment 1 almost twice as long as segment 2, segments 5–10 subserrate with segments as long as broad, apical segment twice as long as broad and evenly acuminate.

Pronotum: Transverse with basal 0.66 of lateral margins straight or nearly so, apical 0.33 conical; integument pitchy, strongly punctate, almost rugose; pubescence almost absent except for sparse silver setae along lateral margins of thorax.

Scutellum: Minute, with fine silver pubescence.

Meso- and Metathorax: Elytra barely longer than broad, apices slightly truncated; integument wholly ferrugineous or with central area covering 0.66 or width of base black and gradually narrowing towards apex, lateral margins of type specimen ferrugineous; pubescence very sparse, setae silver; legs 1 and 2 testaceous to fusco-testaceous, hind pair with femur and most of tibia black or dark ferrugineous, apex of tibia and tarsus ferrugineous; prepectenar ridge of hind femur without serrations.

Pygidium: In male broader than long with strongly arcuate lateral margins and rounded apex; integument black with little or no pubescence; female as broad as long with lateral margins less arcuate and apex sharply rounded, surface strongly convex; integument black; covered with sparse pubescence but with some long, golden, upstanding setae.

Male genitalia: (Fig. 94). Median lobe short and broad; ventral valve triangular; armature of internal sac with 9 spines as follows: pair of large, broad spines with slightly curving apices near base, immediately apical to these another pair of short, pointed spines with wide bases, near middle and apex another group of spines consisting of two dome-shaped pointed spines and a third single slender spine immediately apical to these, together with two very small spines; ejaculatory duct ornamented with an elongated campanulate entrance covered with small spines at its mouth; lateral lobes narrow, elongate, very broad at

apices, apices rounded, with slight medial cleft, several setae on apices.

Female genitalia: Unknown.

Host Plants.—Unknown.

Distribution.—Rhodesia, Congo da Lemba, South Africa, Zimbabwe, Zambia, Sudan, Natal (Decelle 1970: 257; Borowiec 1990a: 387).

Discussion.—*Caryedon nigrosignatus* is in the *Acaciae* Group. See Subgroup 7 of *C. acaciae* for a discussion of this species.

Specimens of *C. nigrosignatus* are consistently smaller in total body size than any other species in the Caryedontini that are known to us. The examples that are known are the type that is in the Pic collection (MNHN) and another specimen that is in the BMNH.

BJS examined a syntype of *Caryedon atricolor* (MRAC) and found it to be synonymous with *C. nigrosignatus*. It is therefore synonymized above. Most of Pic's types are housed in the MNHN.

The holotype ♀ of *C. nigrosignatus* has the following labels: Salisbury Marshall (Pic's handwritten label, MNHN); second specimen ♂, Salisbury, April 1899, Sweeping, Sir Guy Marshall. It is probable that the late Sir Guy Marshall collected all of these specimens together and sent one to Pic for identification. BJS dissected the male and the microscope preparation is in the BMNH.

Caryedon palaestinus Southgate

Figs. 95, 96

Caryedon serratus palaestinus Southgate 1976: 195 (Holotype ♂: Israel, Bet Guvrin, 35 km SW Jerusalem; BMNH); Belinsky & Kugler 1978: 19; Decelle 1979a: 328; Johnson 1983a: 10, 1983b: 14, 1983c: 12; Borowiec 1985: 205; Verma 1989: 246, 1993: 328.

Caryedon serratus palaestinus: Udayagiri & Wadhi 1989: 233. Incorrect subsequent spelling.

Caryedon palaestinus: Pfaffenberger 1984: 220, 1985: 2, 1990: 48; Borowiec 1990a: 388; 1990b: 61; Borowiec & Anton 1993: 146; Anton 1994a: 106, 1998: 74; Yücel 1994: 35; Bagheri-Zenous 1995: 65; Anton *et al.* 1997: 61.

Description.—*General facies:* Integument fuscous with scattered maculations, pubescence of golden setae, with dark setae over maculate areas. Length 4.3–7.0 mm. Width 2.0–2.8 mm.

Head: Integument fusco-testaceous to piceous; median carina prominent, reticulate on either side, width between eyes narrow, slightly longer than length of antennal segment 2; eyes prominent with

large facets; antennal segments 5–10 serrate, segment 1 twice as long as segment 2; wholly testaceous or with segments 1–4 testaceous and rest pitchy or with median transverse section pitchy and rest testaceous to fusco-testaceous.

Pronotum: Transverse, basal 0.5 of lateral margins straight, apical 0.5 conical, integument testaceous to fusco-testaceous; confusedly punctate, punctures of irregular size; pubescence of coarse golden setae.

Scutellum: Longer than broad, covered with fine white pubescence.

Meso- and Metathorax: Elytra together longer than broad; integument fusco-testaceous to fuscous with variable dark maculations, pubescence of coarse golden or pale golden setae with dark setae overlying dark integument varying to all golden setae obscuring dark maculate areas of integument; legs 1 and 2 testaceous to fusco-testaceous; hind pair of same coloration as elytral integument; prepectenar ridge of hind femur with many small serrations sometimes obscured by pubescence, pecten with large first spine followed by 12–13 smaller spines about 0.5 as long as first spine.

Pygidium: In male as long as broad with lateral margins arcuate; in female slightly longer than broad with lateral margins straight; integument in both sexes testaceous to fusco-testaceous with varying amounts of dark integument varying to dark integument occupying whole area of pygidium except margins, pubescence of coarse golden setae interspersed with darker setae.

Male genitalia: (Fig. 95). Median lobe short and broad; ventral valve narrow with lateral margins concave, apex slightly broad, dorsal valve broader, with lateral margins slightly convex, acuminate at apex; armature of internal sac with 10 spines arranged as follows: with three pairs of spines medially and two pairs near apex, apical spines more U-shaped than in *C. serratus* with one side shorter by 0.5 length of other side and ending in a point in largest pair (in *C. serratus* the short side of the U extends for only 0.33 length of the other and is slightly spatulate), pair 3 short and simple, often obscured by mass of small spines (Fig. 95); lateral lobes expanded at apex, cleft to 0.3 their length, with elongate hairs at apices.

Female genitalia: (Fig. 96). Vaginal sclerites with V-shaped indentation along apical margin (straight in *C. serratus*), bursa copulatrix with few spines scattered over surface.

Host Plants.—*Old records*: *Acacia gerrardii* (Southgate 1976: 197); *Acacia gerrardii negevensis* (Anton *et al.* 1997: 61); *A. leucophloea* (Verma 1989: 246, 1993: 328); *A. tortilis* subsp. *raddiana*, *A. t. tortilis* (both Southgate 1976: 197; Decelle 1979a: 328; Udayagiri & Wadhi 1989: 233); *A. tortilis* subsp. *raddiana*, *A. tortilis*, *Prosopis farcta* (*A. t. raddiana* as *A. raddiana*, all Anton *et al.* 1997: 61); *Prosopis farcta* (Southgate 1976: 197; Decelle 1979a: 328); *P. cineraria* (as *P. spicigera*; Bagheri-Zenous 1995: 65).

New records: None.

Distribution.—Israel. Iran (Southgate 1976: 197). Egypt, Iraq, Iran, Saudi Arabia, Sudan, Chad (Borowiec 1990a: 388). From Algeria to Oman, western Pakistan, southern Turkmenistan, Iran (Anton *et al.* 1997: 61, Anton 1998: 74).

Discussion.—*Caryedon palaestinus* is in the *Serratus* Group. See *C. serratus* discussion for a discussion of this species and other members of Subgroup 3.

Southgate (1976) observed that *C. serratus* and *C. palaestinus*, when allowed to breed in the lab, could not produce offspring beyond the first filial generation. This observation supports that these are biological species. Pfaffenberger (1984) described significant differences in the first instar larvae of the two species. Therefore, citing all of the above evidence, Pfaffenberger (1984) raised *C. palaestinus* from subspecific to specific status.

Caryedon pallidus (Olivier)

Figs. 97, 98

Bruchus pallidus Olivier, 1790: 199 (Senegalia; Neotype ♂: Nigeria: Kano District; BMNH); Gyllenhal in Schoenherr 1833: 97; Schoenherr 1839: 130; Southgate 1971 (neotype designation).

Pachymerus pallidus: Pic 1913: 8, 1950a: 211; Bridwell 1929: 145; Lukianovich & Ter-Minasian 1957: 62; Wendt 1986: 106, 1988: 315.

Caryoborus pallidus: Fairmaire 1885: 65; Baudi 1887: 65; Schilsky 1905: XXXI. 7; Hoffmann 1945: 99; Shomar 1963: 193; Yus Ramos 1976b: 193; de Luca 1980: 42.

Caryoborus pallidulus: Schilsky 1905: F. Incorrect subsequent spelling.

Caryedon pallidulus: Udayagiri & Wadhi 1989: 232. Incorrect subsequent spelling.

Pachymerus pallidulus: Pic 1913: 8. Incorrect subsequent spelling.

Caryedon pallidus: Decelle 1951: 188, 1960a: 72, 1969: 295, 1979a: 328; Zacher 1952: 469; Prevett, 1965: 529, 1966: 10, 1967a: 3, 1971: 279; Southgate, 1971: 409, 1979: 460; Cock & Evans 1984: 342; Hideux 1984:

327; Pfaffenberger 1985: 2; Udayagiri & Wadhi 1989: 232; Borowiec 1990a: 388; Lienard *et al.* 1992: 339; Delobel *et al.* 1995b: 81; Silvain & Delobel 1998: 534; Delobel *et al.* 2000: 65.

Description.—Male. *Head*: With prominent median carina on frons; eyes bulbous; antenna serrate, dark testaceous, apical 0.33 or 0.5 of each segment sometimes darker. Length 3.5–5.0 mm. Width 1.8–2.5 mm.

Pronotum: With lateral margins parallel for 0.66 length from basal corner, then convergent; surface punctate, punctures of uniform size; cuticle usually dark testaceous varying to rufous; pubescence pale golden.

Scutellum: Subquadrate.

Meso- and Metathorax: Elytra usually dark testaceous, varying to very pale, some specimens with dark sutural line extending laterally to second interstice; legs dark testaceous, some specimens with apex of hind femur black; pecten of hind femur with large first spine followed by 9–10 denticles.

Pygidium: With lateral margins almost straight, narrowing anteriorly, apex with shallow median indentation, cuticle dark testaceous, pubescence pale golden, thickly covering cuticle. Female similar to male except that pygidium broader with lateral margins more rounded, apex without median indentation.

Male genitalia: (Fig. 97). Median lobe short and broad; ventral valve broad at base, deeply concave laterally, elongate, narrowing to acuminate apex, dorsal valve narrow, lateral margins convex, gently curved to acuminate apex; armature of internal sac with 6 spines as follows: pair of large, curved spines at base, pair of longer and thinner spines and a third, thin pair clumped medially, spines sometimes embedded in dense clump of spinules (Fig. 97); entrance to ejaculatory duct with concave lateral margins ornamented with numerous small spines; lateral lobes narrow, elongate, broadened at apices, apices rounded with slight medial cleft, apices with many elongate spines.

Female genitalia: (Fig. 98). Vaginal sclerites comprised of an oval plate with another, more heavily sclerotized plate superimposed upon its apical 0.33 and extending above it; neck of bursa copulatrix with two rows of spines, bursa copulatrix ornamented.

Host Plants.—*Old records*: *Acacia ataxacantha*

(Southgate 1971: 409; Udayagiri & Wadhi 1989: 233; Delobel *et al.* 1995: 81); *A. nilotica* (as *A. arabica*; Peake 1952: 318; Udayagiri & Wadhi 1989: 233, 234); *A. vereck* (as *A. vereck*; Udayagiri & Wadhi 1989: 233); *A. verugera* (Peake 1952: 318); *Arachis hypogaea* (Lukianovich & Ter-Minasian 1957: 35; Davey 1958: 388); *Cassia mimosoides* L. (Southgate 1971: 409; Udayagiri & Wadhi 1989: 233; Delobel *et al.* 1995: 81); *C. sieberiana* DC. (as *C. kotschyana* Oliver; Udayagiri & Wadhi 1989: 233); *C. tora* (Hideux 1984: 327); *Senna alexandrina* (as *Cassia acutifolia*; Davey 1958: 388; as *C. angustifolia*; Zacher 1952: 472; Udayagiri & Wadhi 1989: 232, 233); *Faidherbia albida* (as *Acacia albida*; Peake 1952: 318; Udayagiri & Wadhi 1989: 234); *S. italica* (as *C. italica*; Southgate 1971: 409; Udayagiri & Wadhi 1989: 233; Delobel *et al.* 1995: 81); *S. italica* subsp. *italica* (as *C. obovata* Colad.; Zacher 1952: 472; Shomar 1963: 193; Udayagiri & Wadhi 1989: 233); *Senna obtusifolia* (as *Cassia obtusifolia*; Prevett 1965: 530; Southgate 1971: 409; Cock & Evans 1984: 342; Udayagiri & Wadhi 1989: 233; Delobel *et al.* 1995: 81); *S. occidentalis* (as *Cassia occidentalis*; Decaux 1894: 128; Southgate 1971: 409; Udayagiri & Wadhi 1989: 233; Lienard *et al.* 1992: 339; Delobel *et al.* 1995: 81); *S. singueana* (as *Cassia singueana*; Southgate 1971: 409; Udayagiri & Wadhi 1989: 233).

New records: None.

Distribution.—Senegal (Olivier 1790: 199; Delobel *et al.* 1995b: 81; Silvain & Delobel 1998: 534; Delobel *et al.* 2000: 65); Greece, Syria, Turkey, Lusitania, the Caucasus (Baudi 1886). Gambia, from Senegal to Nigeria (Borowiec 1990a: 388). Turkey, Greece, Syria, Egypt (Hoffmann 1945: 99). Eastern Ethiopia (Yus Ramos 1976b: 193). Belgian Congo (Decelle 1960a: 72). Nigeria (Southgate 1971: 409).

Discussion.—*Caryedon pallidus* is in the *Acaciae* Group. See *C. acaciae* and *C. germari* for a discussion of this species and other members of Subgroup 6.

Judging from the interpretation of Borowiec (1990a) of the male genitalia of *C. pallidus*, he was unaware that Southgate (1971) had designated a neotype for *C. pallidus*. We recognize the male genitalia in Figure 97 as being those of *C. pallidus*.

According to BJS, the collection of Olivier with all its types was lost. Thus, all identifications must be based on the original descriptions together with any figures and on collections from the type locality. With *C. pallidus*, its external similarity to other species of *Caryedon* has led to considerable

confusion and a number of misidentifications in the literature that have been perpetuated by various authors. For example, Decelle (1951) indicated that *C. pallidus*, *C. serratus*, and *C. gonagra* are junior synonyms of *C. fuscus* but because data accumulated in our studies show differences between these species, we do not believe Decelle's interpretation to be valid. Olivier gives "Senegalia" as the type locality for the species. Many samples of *Caryedon* have been collected from West Africa and placed together with a presumably identical species from the eastern side of the Sahara under the name *C. pallidus*. Samples of these *Caryedon* from both sides of the Sahara feed in seeds of *Cassia*. Examination of specimens reared from seeds of *C. obtusifolia* taken in West Africa, i.e., Sierra Leone, Nigeria, the former French West Africa, etc., in recent years showed a marked difference in the male genitalia from those found on the eastern side of the Sahara. Southgate (1971) concluded that these specimens from the east side of the Sahara were actually a distinct species and named it *C. sudanensis*. Thus, the type locality of *C. pallidus* is in West Africa and that of *C. sudanensis* is in East Africa. Current records of distribution in the literature, especially of *C. pallidus*, must be carefully evaluated. For example, Baudi (1886) lists *C. pallidus* from Greece, Syria, Turkey, Lusitania and the Caucasus. This is also followed partly by Hoffman (1945) who adds that the species has been introduced into parts of France.

Caryedon pallidus annulicornis Pic

Pachymerus pallidus annulicornis Pic 1950a: 211 (Type: Dabaga).

Caryedon pallidulus annulicornis: Udayagiri & Wadhi 1989: 232.

This subspecies of *C. pallidus* with yellow and dark antennae was reported from Dabaga (now in Tanzania) by Pic. We consider this to be a variety of *C. pallidus*. We know of no host plants for this subspecies.

Caryedon prozysniskii Borowiec

Fig. 99

Caryedon prozysniskii Borowiec 1990a: 388 (Holotype ♂: Ghana, Legon, Botanical Garden; PAN).

Description.—Paraphrased from Borowiec

(1990a). *General facies*: Integument color reddish yellow; antennal segments 5–11 black; vestiture uniform, grayish, sparse, not covering body surface. Length (pronotum—elytra) 2.8–3.3 mm. Width 1.5–1.7 mm.

Head: Short, distance from base of antenna to apex of labrum about 0.33 distance from upper limits of eyes to apex of labrum; frons narrow with sharp median carina, in narrowest part about as wide as three eye facets together; ocular sinus about 0.1 times as long as eye; tempora as wide as two ocular facets together; antennal segments 1–4 filiform, 2 shorter than other segments, 5–10 about 1.2 times longer than wide, 11 about twice longer than wide; antenna reaching to 0.25 elytral length.

Pronotum: Pentagonal, lateral margins in basal 0.66 subparallel, disc flat, without impressions, densely punctate, puncture diameter twice distance between punctures, space between punctures with small secondary punctation; lateral prothoracic carina extending 0.7 distance to anterior edge of pronotum; prosternum separating procoxae for about 0.3 their length.

Scutellum: Small, rounded apically.

Meso- and Metathorax: Elytron about 3.2 times longer than wide; striae moderately impressed, indistinctly punctate, intervals smooth, striae 4 and 5 shortened posterad, striae 2 and 3 sometimes closed posterad; hind femur about twice longer than wide, prepectenar ridge distinctly serrate, pecten with 10 spines, first spine about twice longer than second, remaining spines gradually smaller, hind tibia arcuate, with complete set of carinae, mucro about as long as width of tibial apex.

Abdomen: Unmodified, last sternum not emarginate.

Male genitalia: (Fig. 99). Median lobe short and broad; ventral valve very broad at base, lateral margins deeply concave, apical portion of valve medial, narrow, short, with acuminate apex; dorsal valve not broad at base, more elongate, lateral margins sinuate, with rounded apex; armature of internal sac with 12 spines arranged as follows: near base first pair large, thick, hooked at basal end, second pair very small, lateral to base of first pair, three pairs clumped from middle to near apex, near middle pair of curved spines, about 0.75 size of pair one, fourth pair elongate, straight, fifth pair elongate, straight, 0.5 as long as fourth pair, sixth pair with enlarged base (Fig. 99).

Female: Similar to male but last sternum abdominal more elongate.

Host Plants.—Unknown.

Distribution.—Ghana.

Discussion.—*Caryedon prozysniskii* is in the *Acaciae* Group. See *C. acaciae* for a discussion of this species and other members of Subgroup 5.

This small species with a uniformly colored body is allied to *C. pallidus* and its relatives. It differs distinctly, however, in the structure of the male genitalia that have 12 spines (in *C. pallidus* there are only 6). The third pair of spines is large, hook-like (in *C. pallidus* these spines small and straight). The spines in *C. cassiae* are generally similar to this species but the last pair of spines is arched while in *C. prozysniskii* these sclerites are straight.

Caryedon sahelicus Decelle, *nomen nudum*

Caryedon sahelicus Decelle 1979a: 328. *Nomen nudum*.

Decelle (1979a: 328) referred to the name *Caryedon sahelicus* Decelle as being published in a paper by Decelle (1979, "Rev. Zool. Afr., sous presse"). He (1979a) noted specimens from Mauritania, Senegal, Mali, and Upper Volta, as well as Saudi Arabia, but no description was given. Unfortunately the "in press" paper was never published. However, several authors have referred to this as a valid name, but it is actually a *nomen nudum*. Anton (1994a) and Silvain & Delobel (1998) correctly noted this as a *nomen nudum*.

***Caryedon serratus* (Olivier)**

Figs. 1, 3, 14, 17, 19, 20, 100–102, 143

Bruchus serratus Olivier 1790: 199 (Lectotype ♂: Senegalia; NRS); Gyllenhal in Schoenherr 1833: 94; Bridwell 1929: 142.

Caryedon serratus: Schoenherr 1823: 1134; Bridwell 1932: 106; Decelle 1951: 188, 1966: 169, 1968: 425, 1969: 253; Prevett, 1967a: 3, 1967b: 267, 1967c: 117, 1968: 247, 1971: 278, 1979a: 328; Bottimer 1968: 1037; Kingsolver 1968: 280, 1992: 22; Vélez 1972: 71; Singh 1973: 68, 1978: 199; Vats 1976: 103; Southgate 1976: 195; Arora 1977: 99, 1978: 41; Kingsolver, *et al.* 1977: 119; Pajni & Singh 1977: 225; Arora & Singal 1978: 86; Belinsky & Kugler 1978: 19; Southgate 1978: 222, 1979: 453; de Luca 1980: 42; Johnson & Kingsolver 1981: 409; Robert *et al.* 1982: 323; Hamon *et al.* 1982: 328; Johnson 1983a: 10, 1983b: 13, 1983c: 12, 1985: 207, 1986: 264; Pfaffenberger 1984: 220, 1985: 2;

Borowiec 1985: 205, 1988: 70, 1990b: 61; Rasplus 1988: 64; Udayagiri & Wadhi 1989: 233; Delobel 1989: 351; Maes & Kingsolver 1991: 32; Nilsson & Johnson 1992: 62; Nilsson & Johnson 1993: 5; Borowiec & Anton 1993: 147; Anton 1994a: 106, 1998: 74; Delobel *et al.* 1995a: 214; Delobel *et al.* 1995b: 79; Poole *et al.* 1996: 161; Sembène & Delobel 1996: 357, 1998: 171; Anton *et al.* 1997: 61; Delobel *et al.*, 2000: 65; Silvain & Delobel 1998: 534; Romero & Johnson 2002: 95.

Pachymerus serratus: Pic 1913: 7.

Bruchus gonagra Fabricius 1798: 159 (Syntypes: India orientali; UZMC).

Caryedon gonagra: Bridwell 1920: 337, 1929: 145, 1946: 56; Herford 1935: 22; Southgate & Pope 1957: 671; Davey 1958: 385; Hinckley 1960: 260; Calderon 1962: 215; Prevett 1965: 523, 1966: 9, 1967a: 5; Decelle 1965: 215; Johnson 1966: 162; Janzen 1969: 18; Johnson & Kingsolver 1971: 151; Vats 1973a: 133, 1973b: 168; Center & Johnson 1974: 1098; Smith & Brower 1974: 323; Cancela da Fonseca 1975: 71; Vazirani 1975: 753; de Luca 1977: 11; Belinsky & Kugler 1978: 19; Wendt 1978: 365; Borowiec 1980: 14; Udayagiri & Wadhi 1989: 234.

Caryoborus gonagra: Allard 1895b: 225; Swezey 1925: 3; Ward *et al.* 1977: 5.

Pachymerus gonager: Pic 1913: 7; Mukerji & Chatterjee 1951: 28; Mathur, *et al.* 1958: 3. Incorrect subsequent spelling.

Caryoborus fuscus: Bedel 1901 (partim, nec *fuscus* Goeze 1777).

Pachymerus fuscus: Bedel 1901 (partim); Pic 1913: 7.

Caryedon fuscus: Bedel 1901 (partim).

Caryedon fuscus (nec *fuscus* Goeze 1777): Bridwell 1929: 144, 1932: 132, 1946: 56; Herford 1935: 21; Decelle 1951: 188, 1956: 426, 1960a: 72; Southgate & Pope 1957: 670; Davey 1958: 385; Prevett 1965: 526; Bottimer 1968: 1037; Belinsky & Kugler 1978: 19; Pfaffenberger 1985: 1; Abdul-Rassoul 1990: 7.

Caryoborus tamarindi Decaux 1894: 128 (Syntypes: India; MNHN); Pic 1913: 9. **New synonymy.**

Pachymerus tamarindi: Shomar 1963: 191.

Caryedon tamarindi: Vazirani 1975: 754; Udayagiri & Wadhi 1989: 235.

Pachymerus sicutensis Pic 1924a: 25 (nec Pic 1950: 211) (Holotype: Congo; MNHN).

Caryedon sicutensis: Decelle 1960a: 73, 1966: 171; Udayagiri & Wadhi 1989: 234.

Pachymerus notativentris Pic 1924a: 24 (Holotype: Indes; MNHN?); Vazirani 1975: 753; Udayagiri & Wadhi 1989: 244.

Caryedon notativentris: Zacher 1936: 12, 1952: 469; Lukianovich & Ter-Minasian 1957: 35; Davey 1958: 385.

Caryedon irakensis Al-Ali & Ali 1988: 3 (Holotype ♂: near city of Bigi, Iraq, 43°33'N, 34°56'E; INHM). **New synonymy.**

Description.—*General facies:* Integument fuscous with scattered maculations; pubescence of golden setae, with dark setae over maculate areas. Length 3.5–6.8 mm. Width 1.8–3.0 mm.

Head: Integument fusco-testaceous to piceous; median carina prominent, reticulate on either side; width between eyes narrow, slightly longer than length of antennal segment 2; eyes prominent with large facets; antennal segments 5–10 serrate; segment 1 twice as long as segment 2; wholly testaceous or with segments 1–4 testaceous and the rest pitchy or with median transverse section pitchy and remainder testaceous to fusco-testaceous.

Pronotum: Transverse, basal 0.5 of lateral margins straight, apical 0.5 conical, integument testaceous to fusco-testaceous; confusedly punctate, punctures of irregular size; pubescence of coarse golden setae.

Scutellum: Longer than broad, covered with fine white pubescence.

Meso- and Metathorax: Elytra together longer than broad; integument fusco-testaceous to fuscous with variable dark maculations; pubescence of coarse golden or pale golden setae with dark setae overlying dark integument but varying to some with wholly golden setae obscuring dark maculate areas of integument; legs 1 and 2 testaceous to fusco-testaceous; hind femur of same coloration as elytral integument, prepectenar ridge with many small serrations sometimes obscured by pubescence, pecten with large first spine followed by 12–13 smaller spines about 0.5 as long as first spine.

Pygidium: In male as long as broad with lateral margins arcuate; in female slightly longer than broad with lateral margins straight; integument in both sexes testaceous to fusco-testaceous with varying amounts of dark integument, varying to some with dark integument occupying entire pygidium except for margins; pubescence of coarse golden setae interspersed with darker setae.

Male genitalia: (Figs. 14, 100). Median lobe broad; ventral valve with lateral margins sclerotized, concave, narrowing to acuminate apex; dorsal valve with lateral margins convex, apex rounded; armature of internal sac with 8 spines arranged as follows: with patches of fine spinules at base, middle and apex; near middle two large hook-shaped spines with broad bases, lateral to these two short, thick spines with slightly hooked tips, near apex two pairs of long, thin, curved

spines, one pair narrow, more elongate, the other thicker with very slightly spatulate bases; lateral lobes elongate, with a deep medial cleft, apices of lobes sclerotized, cupped, with long setae.

Female genitalia: (Figs. 101, 102). With strongly defined vaginal plates; neck of bursa copulatrix with cluster of sharply pointed small spines at base leading to elongated bursa copulatrix ornamented with strongly sclerotized spines arising from rounded bases; spiculum ventrale V-shaped with comparatively thick lateral margins and bulbous area above point of junction of lateral margins narrowing to very long thin extension at basal end.

Host Plants.—*Old records:* *Acacia chundra* (Udayagiri & Wadhi 1989: 234); *A. confusa* (Zacher 1952: 470; Davey 1958: 388; Udayagiri & Wadhi 1989: 234); *A. farnesiana* (Bridwell 1918: 477, 1919: 15, 1920: 339; Zacher 1952: 470; Davey 1958: 387; Ward *et al.* 1977: 5; Udayagiri & Wadhi 1989: 234); *A. gerrardii* (Halevy 1974: 122; Southgate 1976: 197); *A. leucophloea* (Verma 1989: 246, 1993: 328); *A. nilotica* (El Atta 1993: 170; as *A. arabica*; Zacher 1952: 470; Davey 1958: 387; Arora 1977: 99; Arora & Singal 1978: 86); *A. nilotica* subsp. *tomentosa* (Udayagiri & Wadhi 1989: 234); *A. pennata* (Zacher 1952: 471; Davey 1958: 387); *A. senegal* (Zacher 1952: 471; Davey 1958: 388; Udayagiri & Wadhi 1989: 234); *A. tortilis* (Belinsky & Kugler 1978: 19; Udayagiri & Wadhi 1989: 234); *A. t.* subsp. *raddiana* (Southgate 1976: 197; Decelle 1979a: 328; Udayagiri & Wadhi 1989: 233, 234); *A. tortilis* subsp. *spirocarpa* (as *A. spirocarpa*; Belinsky & Kugler 1978: 19; Udayagiri & Wadhi 1989: 234); *A. t.* subsp. *tortilis* (Southgate 1976: 197; Decelle 1979a: 328; Udayagiri & Wadhi 1989: 233); *Albizia lebbeck* (L.) Benth. (Davey 1958: 387; Arora 1977: 99; Arora & Singal 1978: 86; El Atta 1993: 170; Udayagiri & Wadhi 1989: 234); *Arachis hypogaea* (Davey 1958: 388; Prevett 1965: 528, 1967a: 5; Johnson 1966: 162, 1986: 264; Southgate 1978: 223; Delobel 1989: 351; Udayagiri & Wadhi 1989: 234; Pierre & Huignard 1990: 94; Kingsolver 1992: 22; Nilsson & Johnson 1992: 62; El Atta 1993: 170; Sembène & Delobel 1996: 357, 1998: 171; Romero & Johnson 2002: 95); *Bauhinia acuminata* L. (Zacher 1952: 471; Udayagiri & Wadhi 1989: 234); *B. galpinii* (Zacher 1952: 471; Davey 1958: 388; Udayagiri & Wadhi 1989: 234); *B. malabarica* (Zacher 1952: 471; Davey 1958: 388; Udayagiri & Wadhi 1989: 234); *B. monandra* (Bridwell 1918: 477; Zacher 1952: 471; Davey 1958: 388; Ward *et al.* 1977: 5; Rasplus 1988: 64; Udaya-

giri & Wadhi 1989: 234; Delobel *et al.* 1995: 81); *B. racemosa* (Stebbing 1914: 251; Zacher 1952: 471; Davey 1958: 388; Udayagiri & Wadhi 1989: 234); *B. reticulata* (as *Piliostigma reticulatum*; Prevett 1965: 528, 1967a: 5; Udayagiri & Wadhi 1989: 234; Delobel *et al.* 1995: 81; Sembène & Delobel 1996: 357, 1998: 172); *B. rufescens* (Prevett 1967a: 5; Udayagiri & Wadhi 1989: 234; Pierre & Huignard 1990: 94; Sembène & Delobel 1996: 357, 1998: 171); *B. thonningii* (as *Piliostigma thonningii*; Prevett 1965: 528, 1967a: 5; Rasplus 1988: 64; Udayagiri & Wadhi 1989: 234; Delobel 1989: 351; Delobel *et al.* 1995: 81; Sembène & Delobel 1998: 172); *B. tomentosa* (Bridwell 1918: 477; Zacher 1952: 471; Davey 1958: 388; Ward *et al.* 1977: 5); *B. variegata* (Nilsson & Johnson 1992: 62; Anton *et al.* 1997: 61; Romero & Johnson 2002: 95); *Caesalpinia pulcherrima* (Bridwell 1918: 477; Davey 1958: 388; Ward *et al.* 1977: 5; Udayagiri & Wadhi 1989: 234); *Cassia arereh* (Prevett 1965: 528; Udayagiri & Wadhi 1989: 234); *C. brewsteri* (Zacher 1952: 472; Davey 1958: 388; Udayagiri & Wadhi 1989: 234); *C. fistula* (Stebbing 1914: 251; Bridwell 1918: 477; Zacher 1952: 472; Davey 1958: 387; Prevett 1966: 10; Ward *et al.* 1977: 5; Arora 1977: 99; Arora & Singal 1978: 86; Udayagiri & Wadhi 1989: 234); *C. foetida* (Davey 1958: 388; Udayagiri & Wadhi 1989: 234); *C. grandis* (Bridwell 1918: 477; Zacher 1952: 472; Davey 1958: 387; Ward *et al.* 1977: 5; Udayagiri & Wadhi 1989: 234); *C. javanica* (Zacher 1952: 472; Davey 1958: 388; Udayagiri & Wadhi 1989: 234); *C. javanica* subsp. *nodosa* (as *C. nodosa* Buch.-Ham. ex Roxb.: Bridwell 1918: 477 1919: 18; Davey 1958: 387; Ward *et al.* 1977: 5; Udayagiri & Wadhi 1989: 234); *C. moschata* (Romero & Johnson 2002: 95); *C. montana* (Stebbing 1914: 251; Davey 1958: 388; Udayagiri & Wadhi 1989: 234); *C. muritura* (Stebbing 1914: 251; Davey 1958: 388; Udayagiri & Wadhi 1989: 234); *C. sieberiana* (Prevett 1965: 528, 1967: 5, 1971: 270; Udayagiri & Wadhi 1989: 234 Delobel *et al.* 1995: 81; Sembène & Delobel 1996: 357, 1998: 172; as *C. kotschyana* Oliver: Davey 1958: 388; Udayagiri & Wadhi 1989: 234); *Casuarina equisetifolia* (Stebbing 1914: 251; Davey 1958: 387; Udayagiri & Wadhi 1989: 234); *Delonix regia* (as *Poinciana regia*: Zacher 1952: 472; Davey 1958: 388; Udayagiri & Wadhi 1989: 234); *Dialium guineense* (Zacher 1952: 472; Davey 1958: 388; Udayagiri & Wadhi 1989: 234); *Erythrina monosperma* (Davey 1958: 388; Udayagiri & Wadhi 1989: 234); *Faidherbia albida* (Del.) A. Chev. (as *A. albida*: Udayagiri & Wadhi

1989: 234); *Falcataria moluccana* (as *Adenanthera falcate*: Decaux 1894: 128); *Hardwickia binata* (Davey 1958: 387); *Oryza sativa* (Arora & Singal 1978: 86; Udayagiri & Wadhi 1989: 234); *Parkinsonia praecox* (as *Caesalpinia praecox*: Zacher 1952: 472; Davey 1958: 388; Udayagiri & Wadhi 1989: 234); *Piliostigma malabaricum* (as *Bauhinia malabarica*: Udayagiri & Wadhi 1989: 234); *Pongamia pinnata* (Singal & Toky 1989: 91); *Prosopis africana* (Udayagiri & Wadhi 1989: 234; as *P. oblonga* Benth.: Udayagiri & Wadhi 1989: 234); *P. alba* (Udayagiri & Wadhi 1989: 234); *P. chilensis* (Zacher 1952: 471; Davey 1958: 388; Hinckley 1960: 262; Udayagiri & Wadhi 1989: 234); *P. cineraria* (as *P. spicigera*: Zacher 1952: 471; Davey 1958: 388; Udayagiri & Wadhi 1989: 234); *P. farcta* (Southgate 1976: 197; Decelle 1979a: 328); *P. juliflora* (Bridwell 1918: 477, 1920: 408; Davey 1958: 389; Ward *et al.* 1977: 5; Al-Ali & Ali 1988: 1; Udayagiri & Wadhi 1989: 234; Anton *et al.* 1997: 61); *P. pallida* (Kingsolver 1977: 119); *Rhamnus purshiana* (Davey 1958: 388; Udayagiri & Wadhi 1989: 234); *Senna alexandrina* (as *Cassia acutifolia*: Udayagiri & Wadhi 1989: 234); *S. auriculata* (as *Cassia auriculata*: Davey 1958: 387; Udayagiri & Wadhi 1989: 234); *S. italica* subsp. *italica* (as *C. obovata* Colad.: Udayagiri & Wadhi 1989: 234); *Tamarindus indica* (Decaux 1894: 128; Stebbing 1914: 251; Bridwell 1918: 477; Zacher 1952: 471; Davey 1958: 387; Shomar 1963: 191; Prevett 1965: 528, 1967a: 5; Johnson 1966: 162, 1986: 264; Velez Angel 1972: 72; Arora 1977: 99; Ward *et al.* 1977: 5; Arora & Singal 1978: 86; Belinsky & Kugler 1978: 20; Delobel 1989: 351; Udayagiri & Wadhi 1989: 234; Nilsson & Johnson 1992: 62; Kingsolver 1992: 22; Delobel *et al.* 1995: 81; Sembène & Delobel 1996: 357, 1998: 173; Romero & Johnson 2002: 95); *Terminalia arjuna* (Zacher 1952: 478; Davey 1958: 388; Udayagiri & Wadhi 1989: 234).

New records: None.

Distribution.—Worldwide in tropical, subtropical and warm regions.

Discussion.—*Caryedon serratus* is in the *Serratus* Group. See discussion of Subgroup 3 below for a discussion of this species.

Caryedon serratus, probably because of its economic importance and its distribution in the tropical, subtropical and warmer areas of the world, has had more confusion surrounding its identity than any other species in the tribe. Because it feeds in seeds of introduced and native plants in the Old World and New World, various authors

have placed it in at least four genera (*Bruchus*, *Caryoborus*, *Pachymerus*, *Caryedon*) and at least seven different specific names have been applied to it (see synonymy). Southgate & Pope (1957) dealt with the general taxonomic position of the species. Since then, Decelle (1966) has shown that the valid name for the species is *Caryedon serratus* and added *C. sibiricus* Pic (1924a) to the list of synonyms. Here we add *C. tamarindi* and *C. irakensis* as synonyms. Careful studies of the original descriptions of *C. tamarindi* and *C. irakensis* led BJS and CDJ respectively to the conclusion that the two names are synonymous with *C. serratus*.

Decelle (1966: 172), after examining the type of *Bruchus fuscus* Goeze (1777), considered it to be a member of the New World genus *Caryobruchus* and not a synonym of *Bruchus serratus* Olivier. Nilsson & Johnson (1993: 23) agreed with Decelle and considered *C. fuscus* to be a junior synonym of *Caryobruchus gleditsiae* (Johansson & Linnaeus).

BJS separated the *Serratus* Group from all other groups of *Caryedon* because the elytra, hind femora and sometimes the thorax have randomly arranged light or dark maculations (Fig. 143).

The *Serratus* Group of *Caryedon* is composed of 10 species forming three natural subgroups.

Subgroup 1 of the *Serratus* Group is composed of *C. fuliginosus*. It is distinct from other species in the group by having the lateral margins of the ventral valve of the male genitalia straight to slightly convex, not concave as with most other members of the group (Fig. 57). The armature of the internal sac is also unique in that it has six spines in a distinct pattern as follows: with two large U-shaped spines near the base, apical to these a second pair of slender, slightly curved spines, spatulate at base, and another longer, almost straight pair with rounded, slightly bulbous basal ends at the apex of the internal sac (Fig. 57).

Subgroup 2 of the *Serratus* Group is composed of *C. conformis* and *C. fasciatus*. These two species are grouped together because the apices of the ventral valves of the male genitalia are truncate with a slight concavity. The male genitalia of *C. conformis* have a ventral valve that is strongly sclerotized with concave lateral margins that narrow to a moderately broad, truncated apex (Fig. 38) that is unique within the group. In addition, the armature of the internal sac of the male genitalia has five distinctive spines as follows: with a pair of large foot-shaped spines and a pair of slightly

curved spines with strongly curved and slightly expanded bases all embedded in a mass of minute spines near the base, with one thin, straight, short spine apical to these (Fig. 38). *Caryedon fasciatus* (Fig. 51) differs by having a ventral valve with concave lateral margins, slightly convex before apex, then a slight concavity near the broad apex with a concavity. Additionally, the armature of the internal sac has ten spines arranged in a unique pattern (Fig. 51). There is a clump of spines near the base consisting of four pairs of spines in the following pattern: a pair of long curved spines broadened at base, slightly apical to these three pairs of shorter spines, one pair slightly thicker than the rest, with hooked tips. Apical to these is a pair of thin, more sharply pointed spines with broadly spatulate bases.

Subgroup 3 is the largest subgroup of the *Serratus* Group. It is composed of seven species with male genitalia that have about four to ten spines in the internal sac, the ventral valve has an acuminate apex and its lateral margins are concave. All are similar to *C. serratus* but we will compare the five species *C. johnei*, *C. serratus*, *C. meinanderi*, *C. grandis*, and *C. palaestinus* first because they are most similar to one another. *Caryedon maculatus* and *C. longus* are more divergent from these five species.

Caryedon serratus is most similar to *C. johnei* and externally differs only in the slightly broader and stouter antennae. The median lobe of the male genitalia of *C. serratus* (Fig. 100) differs also in that the two pairs of stout sclerites near the base are shorter and the apical, thin pair of sclerites have the base curved in the arch only (Fig. 100) while in *C. johnei* the base of the last thin sclerite is S-shaped (Fig. 73). The sclerites of the ovipositor of *C. serratus* (Figs. 101, 102) are slightly shorter and stouter and the vaginal sclerite is similar in shape to that of *C. johnei*, but it is stouter, about equal in length and width (Figs. 74, 75, 76).

Caryedon palaestinus has an internal sac with three pairs of spines medially and two pairs near the apex, the apical spines are more U-shaped than in *C. serratus* with one side shorter by 0.5 the length of the other side and ending in a point in the largest pair (in *C. serratus* the short side of the U extends for only 0.33 the length of the other and is slightly spatulate), the third pair is short and simple, often obscured by a mass of small spines. The female genitalia of *C. palaestinus* (Fig. 96)

have vaginal sclerites with a V-shaped indentation along the apical margin (straight in *C. serratus*) and the bursa copulatrix has a few spines scattered over the surface.

Caryedon grandis (Fig. 64) differs from *C. serratus* (Fig. 100) and other species in the armature of the internal sac of the male genitalia. *Caryedon grandis* has two small, very short, lateral spines medially and four identical apical spines. *Caryedon serratus* lacks these two lateral medial spines and has two pairs of apical spines, each pair with its own, unique shape. The female genitalia of *C. grandis* are of a type strongly resembling those of *C. serratus* (Figs. 101, 102) but the unique ventral plate is shortened front and rear, but is less distinctly so on the lateral margins (Fig. 65), and the spiculum ventrale has very broad apical branches (Fig. 66).

Caryedon meinanderi is near *C. serratus* but differs from it and other species in that the spines of the internal sac of *C. meinanderi* are clumped together rather than separated and the curved spines are much shorter and thicker than in *C. serratus* (Fig. 100). The spines in the internal sac of *C. meinanderi* are arranged as follows: with a dense patch of spinules at base, with a pair of large spines that are strongly curved at their tips and with broadened bases. Another pair of pointed spines with broad bases apical to these, then apical to these, two pairs of spines with strongly recurved basal ends, more apical of two pairs shorter and thicker (Fig. 88).

Caryedon maculatus differs from all others in this subgroup and because it has seven spines in the internal sac. The single, longer curved structure sets this species apart from all species in the genus. The spines of the internal sac are arranged as follows (Fig. 158): with a mass of small spines near base, apical to these two large hook-shaped structures with thickened bases broadened basally with a single, small spine on each, near apex is a group of smaller spines consisting of a pair of long, thin, pointed spines, a smaller pair and a single longer curved structure, all in a mass of small spines.

Caryedon longus has four spines in the internal sac. The spines are clumped together and are composed of two pairs of elongate spines. This pattern is distinctive because there is a pair of thick, curved spine-like processes with two small stout spines that appear to be attached to them

(Fig. 80). The armature of the internal sac is described as follows: the base with a pair of thick curved spine-like processes with two small stout spines that appear to be attached and apical to these a pair of thinner, longer almost straight spines with slightly expanded bases.

Caryedon skaifei Johnson, Southgate & Delobel,
new species

Fig. 103

Description.—*General facies:* Integument fusco-rufous, overlaid with golden pubescence, no maculations present. Length 5.7 mm. Width 2.8 mm.

Head: With prominent, sharply defined median carina, glabrous at its basal end and slightly broadened; eyes narrow at anterior edge, width between eyes equal to length of antennal segment 2; eyes with large facets; integument fusco-rufous overlaid with fine setae; antennal segments 1–4 rounded, 5–10 serrate, segments 1.5 times as long as broad, segment 11 long and evenly acuminate.

Pronotum: Transverse with basal 0.66 of lateral margins straight, apical 0.33 conical; integument fusco-rufous confusedly punctate, punctures large and shallow; pubescence fairly sparse.

Scutellum: Longer than broad, overlaid with long, golden pubescence.

Meso- and Metathorax: Elytra together longer than broad, apices truncate; integument fusco-testaceous overlaid with coarse golden pubescence; legs 1 and 2 pale testaceous, hind pair fusco-testaceous; prepectenar ridge of hind femur with 4 or 5 small serrations, pecten with large first spine followed by 14 smaller denticles.

Pygidium: Missing on holotype.

Male genitalia: (Fig. 103). Median lobe short and broad; ventral valve broad at base, lateral margins concave, apex broadly rounded, dorsal valve with broad base, lateral margins convex, apex acuminate; armature of internal sac consists of many large spines, several smaller spines and spinules extending from base to near apex as follows: near base 3 pairs of short, curved spines with broad, spatulate bases, 2 spines lateral to these, immediately apical to these about 15 slightly smaller to much smaller spines, apical to these a series of about 8 or more smaller spines embedded in a mass of spinules, all of internal sac lined with many small spinules, their shapes vary in

different parts of sac (not all drawn in figure); entrance to ejaculatory duct campanulate but feebly sclerotized; lateral lobes narrow, elongate, broadened at apices, with slight medial cleft, lightly sclerotized, with many elongate setae at apices.

Female genitalia: Unknown.

Host Plants.—Unknown.

Type series.—Holotype ♂: SOUTH AFRICA: Tsokwano, K. N. W. 8 myl v. Leeupan, Jan. 1960. H. V. Schalkwyk. R. S. A., Pretoria, N.V.P.B. 245. Elizabeth Grobbelaar of the SANC informed me that the correct spelling and coordinates for the collection locality are "Tshokwana, 24° 47' 00" S 031° 52' 00" E". Holotype deposited in the SANC.

Distribution.—Mpumalanga Province, Kruger National Park, South Africa.

Etymology.—This species is named in honor of the pioneer South African entomologist who studied bruchid beetles, S. H. Skaife.

Discussion.—*Caryedon skaifei* is in the *Acaciae* Group, subgroup 3. See *C. acaciae* for a diagnosis and discussion of this species. The shape of the ventral valve with the apex broadly rounded and the armature of the internal sac described above are diagnostic for this species.

***Caryedon sparsus* Johnson, Southgate & Delobel,
new species**

Figs. 104, 161

Description.—*General facies*: Overall ferrugineous integument, antenna darker, overlaid by very fine pubescence. Length 4.5–5.4 mm. Width 2.4–2.6 mm.

Head: With integument dark fuscous to fusco-piceous, well defined median carina not raised greatly above surrounding area, surface reticulate to punctate with very fine, barely perceptible silver pubescence; eyes narrow, width between eyes at narrowest point equal to length of antennal segment 2, eyes coarsely faceted, prominent; antenna with segments 1–4 rounded, segment 1 twice as long as segment 2, segments 5–10 serrate, apical segment long and slightly unevenly acuminate, segments 1–4 fuscous to fusco-piceous, remainder piceous with extreme apex of segment 11 sometimes slightly fuscous.

Pronotum: Transverse with lateral margins slightly arcuate for basal 0.66 and conical for apical 0.33, basal angles slightly produced; integument ferrugineous, overlaid with very fine silver

to golden pubescence; surface covered with large irregular punctures.

Scutellum: Longer than broad, covered with white pubescence.

Meso- and Metathorax: Elytra together longer than broad, with apices slightly truncated, integument ferrugineous with slight darkening towards apex along sutural line and on apex; pubescence composed of fine silver to golden setae very regularly disposed, sparse, integument easily visible; some examples have integument on humeral callosities glabrous, without setae; legs 1 and 2 testaceous to fuscous, hind pair fuscous; serrations on prepectenar ridge of hind femur scarcely visible, pecten with large first spine and up to eleven smaller denticles.

Pygidium: As broad as long in male, slightly longer than broad in female, male with lateral margins slightly arcuate, female with lateral margins straight; integument fusco-piceous in both sexes, overlaid with fine dark setae intermixed with a few golden setae, female with thin line of whitish setae in longitudinal axis, overall a number of long golden upstanding setae.

Male genitalia: (Fig. 104). Median lobe short and broad; ventral valve with broad base, strongly sclerotized, concave lateral margins form narrow, elongate valve ending in acuminate apex, dorsal valve narrower at base, lateral margins straight with apex acuminate; armature of internal sac with 8 spines extending from base to middle as follows: at base two very large, strongly sclerotized sinuous spines with projections near their bases, apical to these three pairs of shorter, curved or straight, more slender spines than first pair; entrance of ejaculatory duct campaniform, covered with small spines; lateral lobes narrow, elongate, broadened at their apices, with two slight clefts on either side of slight medial hump, apices slightly rounded, with long setae, some setae 2.5 times longer than other setae.

Female genitalia: (Fig. 161). Vaginal sclerites almost circular, lightly sclerotized, with two horn like, more strongly sclerotized processes projecting apically from it; neck of bursa copulatrix narrow and furnished with many sharply pointed spine-like processes, collected into a band across middle; bursa copulatrix armed with broad rounded spines with sharp points.

Host Plants.—Unknown.

Type series.—Holotype ♂ and 6 paratypes:

BECHUANALAND: Seruli, 25-8-1964, G. E. J. Morley. Holotype and paratypes deposited in the BMNH.

Distribution.—Botswana.

Etymology.—This species is named for its relatively sparse pubescence.

Discussion.—*Caryedon sparsus* is in the *Acaciae* Group. See *C. acaciae* for a diagnosis and discussion of this species and other members of Subgroup 5.

***Caryedon sudanensis* Southgate**

Figs. 105, 106, 139

Caryedon sudanensis Southgate 1971: 411 (Holotype ♂: Sudan: Atbara District; BMNH); Decelle 1979a: 328; Udayagiri & Wadhi 1989: 234.

Description.—Male. *General facies*: Overall color very pale testaceous—reddish fuscous, usually paler than *C. pallidus*, pubescence silver or very pale golden. Length 4.2–4.7 mm. Width 2.0–2.3 mm.

Head: With median carina prominent, eyes bulbous with large facets; antenna serrate, unicolorous, otherwise similar to *C. pallidus*.

Pronotum: As in *C. pallidus*, with lateral margins straight for 0.66, then conical, not produced at corners; punctate, punctures of one size; pubescence silver to very pale golden with occasional specimens having dark areas of cuticle in median region or along basal margin.

Scutellum: Longer than broad.

Meso- and Metathorax: Elytra pale testaceous to testaceous (one or two examples studied varied slightly in that alternate interstices 2, 4, 6 and 8 had slightly darker cuticle and in some lights this gave a striped appearance); pubescence silver or pale golden, sparsely covering cuticle; legs testaceous, hind femur sometimes slightly darker, pecten of hind femur with large first spine followed by 9–10 denticles.

Pygidium: As broad as long with lateral margins almost straight, converging towards a narrow, smoothly rounded apex; cuticle dark testaceous or with patches of light and dark areas, pubescence long, silver or pale golden; with a unique, medial tubercle near apex on dorsal surface of pygidium tubercle covered with setae with their apices pointing toward apex of tubercle.

Male genitalia: (Fig. 105). Median lobe short, broad; ventral valve with broad base, lateral mar-

gins deeply concave so valve thin, short, medial apex truncate, dorsal valve narrow, with lateral margins convex, gently curved to acuminate apex; armature of internal sac with 8 spines as follows: pair of large hook-shaped spines at base, then medially a clump of spines consisting of a pair of long thin spines and two pairs of short stout spines; entrance to ejaculatory duct conical, ornamented with many small spines; lateral lobes narrow, elongate, broadened at apices, without medial cleft, with many elongate spines at apices.

Female. Shape of pygidium with lateral margins more rounded and converging less sharply towards apex, with medial tubercle near apex (Fig. 139).

Female genitalia: (Fig. 106). Vaginal sclerites of irregular shape, appear to be arranged in pairs; neck of bursa copulatrix with two rows of double-ended spines and bursa copulatrix with several broad, weakly-sclerotized spines.

Host Plants.—*Old records*: *Senna alexandrina* (as *Cassia senna*: Southgate 1971: 413; Udayagiri & Wadhi 1989: 234).

New records: None.

Distribution.—Sudan. Egypt. Eritrea, Djibouti, Somalia (Decelle 1979a: 328). "Arabia".

Discussion.—*Caryedon sudanensis* is in the *Acaciae* Group. See *C. acaciae* for a discussion of this species and other members of Subgroup 5.

For many years, the species associated with the seeds of *Senna alexandrina* from the Nile Basin have been referred to as *C. pallidus*. Based on superficial characters, this is understandable, as it would agree with the description given by Olivier for his species. Examination of the genitalia of examples reared from seeds of *S. alexandrina* revealed considerable differences between the Nile Basin species, *C. sudanensis*, and another very similar species, the true *C. pallidus* of Olivier, from West Africa. (See Southgate 1971 for a more detailed explanation.) The majority of records of *C. pallidus* given in the literature for the Nile Basin most probably refer to *C. sudanensis*.

Caryedon sudanensis appears to be confined to *Senna alexandrina* although the closely related species *Senna italica italica* may also serve as a host. *Caryedon sudanensis* has a very limited distribution being confined, as far as records at present show, to the Sudan, and Lower Egypt. The economic value of the host *Senna alexandrina* may contribute something to the number of records

from the Sudan region, as this is the main source of the seedpods that are exported to Europe.

Shomar (1963) refers to a *Caryoborus pallidus*, which although unknown to her personally, is stated to be recorded from Egypt from the seeds of *Senna italica italica*. This is almost certain to be a record of *C. sudanensis*, because in BJS's experience, *C. pallidus* has not been found in *S. italica italica*. This may be a misidentification of the plant as the plants are similar in habits and also in the shape of the pods.

Adult *C. sudanensis* are variable in color from pale straw color to reddish brown. The darker specimens are those that resemble *C. pallidus*. Among a series of this species collected by a Finnish Expedition to the Nile Basin and Ethiopia, an interesting variation on the type form was noted in which alternate interstices 2, 4, 6 and 8 had darker integument than the rest. This gave, in certain lights, a striped appearance.

***Caryedon uganda* Johnson, Southgate & Delobel,
new species**

Fig. 107

Description.—*General facies:* Integument fuscous to fusco-piceous overlaid with coarse silver pubescence. Length 5.0 mm. Width 2.8 mm.

Head: With integument fusco-piceous, overlaid with sparse silvery pubescence; median carina prominent; eyes relatively narrow with coarse facets; distance between eyes equal to length of antennal segment 2; basal segments of antenna rounded, the remainder missing on holotype.

Pronotum: Transverse, lateral margins slightly arcuate for basal 0.66, apical 0.33 conical; integument fuscous with large unevenly spaced punctures thinly overlaid with coarse silver pubescence.

Scutellum: As broad as long, covered with coarse silver pubescence.

Meso- and Metathorax: Elytra together longer than broad, striae prominent when viewed from behind; apices of elytra rounded; integument fuscous, thickly overlaid with silver pubescence; legs 1 and 2 fusco-testaceous, hind pair fuscous; prepectal ridge of hind femur with a number of serrations, pecten with first spine followed by 11 smaller denticles.

Pygidium: With lateral margins and apex evenly rounded in female; as broad as long; integument fuscous with pubescence of fine silver setae.

Male genitalia: Unknown.

Female genitalia: (Fig. 107). Vaginal area an elongate tube, with sclerotized area near neck of bursa copulatrix consisting of a centrally placed pair of rods, only slightly more sclerotized than surrounding area, at each of the extreme lateral margins is another rod-like structure with spiral ornamentation, neck of bursa copulatrix short, slightly constricted; bursa copulatrix with two small areas of spines near neck.

Host Plants.—Unknown

Type series.—Holotype ♀: UGANDA: N. 'Chna, -xii. 1925, G. D. H. Carpenter, Coll. No. 2624, Ident. No. Holotype deposited in the BMNH.

Distribution.—Uganda.

Etymology.—The specific epithet *uganda* is a noun in apposition to *Caryedon*.

Discussion. *Caryedon uganda* is in the *Acaciae* Group. See *C. acaciae* for a diagnosis and discussion of this species.

Caryedon uganda differs from other species of *Caryedon* by the unique structure of the female genitalia (Fig. 107). Of possible significance is that the elytra do not have maculations on the integument or pubescence or at most have indefinite darker lines on the thorax or elytra.

***Caryedon vinsoni* Johnson, Southgate & Delobel,
new species**

Figs. 108, 146

Description.—*General facies:* Integument fusco-testaceous, with small irregular maculations, overlaid with fine silver pubescence. Length 6.5–8.0 mm. Width 2.6–3.5 mm.

Head: Fusco-testaceous, with very pronounced median carina, eyes close together, but narrowest point not at apical extremities but about 0.33 from apex, median carina occupies whole of narrowest part, width less than length of antennal segment 2, base of carina glabrous and broad, remainder of cuticle rugose overlaid with fine white setae; eyes coarsely faceted; antenna with segments 1–4 rounded, segment 1 twice as long as segment 2, segments 5–10 serrate, twice as long as wide, apical segment almost evenly acuminate; segments 5–9 dark, remainder testaceous.

Pronotum: Transverse, with lateral margins very slightly curved for basal 0.66 and roundly acuminate for apical 0.33, surface confusedly punctate on fusco-testaceous integument with

large punctures of uneven size; pubescence of fine silver to white setae sparsely covering integument.

Scutellum: Longer than broad; overlaid with fine, white pubescence.

Meso- and Metathorax: Elytra together much longer than broad, integument fusco-testaceous with some small maculate areas mainly in apical half, extreme apex mainly dark and sharply rounded; pubescence of fine silvery white setae overall; legs fusco-testaceous with slight darkening on hind femur, with some maculate areas, hind tibia ferrugineous at base; prepectenar ridge of hind femur with distinct row of 15 small denticles.

Pygidium: Slightly longer than broad in male, lateral margins very slightly arcuate, apex truncated, integument mostly dark except for extreme edges and apex; pubescence of male dense, pubescence of female sparse, more adpressed than male.

Male genitalia: (Figs. 108, 146). Median lobe short and broad; ventral valve elongate, lateral margins slightly concave, acuminate at apex, dorsal valve broader and longer than ventral valve, rounded at apex; armature of internal sac with radular-like structure extending from base for 0.5 its length, two groups of ovoid plates, one surmounted by three sharply pointed spines and the other with two sharply pointed spines and three rounded spines near apex; at apex trumpet-shaped, elongate entrance to ejaculatory duct, ejaculatory duct ornamented at base by a mass of small spinules, lateral arches supporting lateral lobes lightly sclerotized and extending from midway along median lobe to almost unite at its base; lateral lobes narrow, elongate, broadened at apices, cleft to almost 0.5 their length, apices rounded, with long, curled setae.

Female genitalia: Without clearly defined vaginal sclerites, neck of bursa copulatrix armed with a band of strongly sclerotized bifid spines; bursa copulatrix unarmed.

Host Plants.—Unknown.

Type Series.—Holotype ♂, 1 paratype ♂ and 1 paratype ♀, MAURITIUS: Round Island, 5.I.1957, J. Vinson. Holotype and two paratypes deposited in the BMNH.

Distribution.—Mauritius.

Etymology.—This species is named in honor of the late entomologist J. Vinson, who collected specimens of this species and gave them to BJS.

Discussion.—*Caryedon vinsoni* is in the *Denticulatus* Group. See discussion of *C. denticulatus* for a diagnosis and discussion of this species and the *Denticulatus* Group.

Caryedon vinsoni has an elongate radular structure in the internal sac of the male genitalia (Figs. 108, 146) that distinguishes it from most other *Caryedon*. It is distinctly different from the radular structures in the internal sac of the male genitalia of *C. denticulatus* (Fig. 44). We have little data except that the labels of the three specimens give the locality as 'Round Island'. We hope that future collectors will locate this species and its host plant, especially as it forms a link with the species *C. denticulatus* from the island of Madagascar.

Caryedon yemenensis Decelle

Figs. 109, 110

Caryedon yemenensis Decelle 1979a: 328 (Holotype ♂: Arabie Saoudite: Wadi Mizbil; NMB); Borowiec 1985: 205; Udayagiri & Wadhi 1989: 235; Anton 1994a: 107, 1998: 75; Anton *et al.* 1997: 62.

Description.—Translated and paraphrased from Decelle (1979a). Male. *General facies*: Overall color very pale testaceous-reddish fuscous, usually paler than *C. pallidus*, pubescence silver or very pale golden. Length 3.2–4.3 mm (3.5–4.8 with the pygidium).

Head: With median carina prominent, eyes bulbous with large facets; antenna serrate, segments 1–4 very pale testaceous, 5–11 dark.

Pronotum: As in *C. pallidus*, with lateral margins straight for basal 0.66, then conical, not produced at corners, punctate, punctures of one size; pubescence silver to very pale golden, varying to dark areas of cuticle in median region or along basal margin.

Scutellum: Longer than broad.

Meso- and Metathorax: Elytra pale testaceous to testaceous (one or two examples studied varied slightly in that alternate interstices 2, 4, 6 and 8 had slightly darker cuticle and in some lights this gave a striped appearance); pubescence silver or pale golden, sparsely covering cuticle; legs testaceous, hind femur sometimes slightly darker, pecten of hind femur with large first spine followed by 9–10 denticles.

Pygidium: As broad as long with lateral margins almost straight, converging towards a narrow, smoothly rounded apex; cuticle dark testa-

ceous or with patches of light and dark areas, pubescence long, silver or pale golden.

Male genitalia: (Fig. 109). Median lobe short and broad; ventral valve very broad at base, lateral margins deeply concave, valve short and very thin, medial apex truncate, dorsal valve narrow, with lateral margins gently curved, apex acuminate; armature of internal sac with 10 spines at middle as follows: nearest base two large fishhook-shaped spines, then, extending toward apex, 3 pairs of elongate, thin, sometimes curved spines almost as long as first pair, and one pair of slightly curved spines about 0.33 as long as other spines.

Female. Shape of pygidium with lateral margins more rounded and converging less sharply towards apex, with medial tubercle near apex (Fig. 139).

Female genitalia: (Fig. 110). Six vaginal sclerites usually with well-defined margins (Fig. 110); neck of bursa copulatrix with two rows of double-ended spines and bursa copulatrix with several broad, weakly-sclerotized spines.

Host Plants.—*Old records:* *Senna italica* (as *Cassia italica*: Anton 1994: 107; Anton *et al.*, 1997: 62).

New records: None.

Distribution.—Saudi Arabia, Yemen, South Yemen, Aden (Decelle 1979a: 329). Iran, Pakistan, Arabian Peninsula, Israel, Jordan (Anton 1994a: 107, 1998: 75; Anton *et al.* 1997: 62).

Discussion.—*Caryedon yemenensis* is in the *Acaciae* Group. See *C. acaciae* for a discussion of this species and other members of Subgroup 5.

Caryedon yemenensis is very similar to *C. sudanensis*, common on the west of the Red Sea of Sudan, in Eritrea, in Djibouti (Obock) and in the north of Somalia (Gardo). It differs but little from *C. sudanensis* in the genitalia of the males and females. The lengths given by Southgate (1971: 411) for *Caryedon pallidus* and *C. sudanensis* are double the actual lengths: they should read 3.5–5.0 mm for *C. pallidus* and 4.2–4.7 mm for *C. sudanensis*.

Externally, it is difficult to differentiate between *C. sudanensis* and *C. yemenensis*. *Caryedon yemenensis*, however, has antennae that are darkened beginning with segment 5 but in *C. sudanensis* the antennae are completely testaceous. Females of both species have pygidia that bear a small, preapical tubercle.

The male genitalia of *C. yemenensis* (Fig. 109) have an internal sac with two large fishhook-shaped spines near the middle and four pairs of

spines extending to near the apex. In *C. sudanensis*, there are only three pairs of smaller spines apical to the larger spines and the ventral valve terminates in a point that is frequently slightly dilated at the apex (Fig. 105). The female genitalia of *C. yemenensis* usually have six vaginal sclerites with well-defined margins (Fig. 110). In *C. sudanensis*, the vaginal sclerites have very irregular margins and are of a different form (Fig. 106). The differences of the structure of the genitalia are relatively slight but constant. The species of the group appear to feed in seeds of *Cassia*.

GENUS *AFROREDON* DECELLE

Afroredon Decelle 1965: 213. Type species: *Afroredon africanus* Decelle 1965, by original designation; Nilsen & Johnson 1993: 11.

Description.—*General facies:* Small, short, oval beetles (Fig. 6); integument usually light to medium brown, setae often dense, uniformly white.

Head: Short, constricted behind eye; vertex with sharp median, glabrous, carina; eye large, bulging, extending to both dorsal and ventral sides of head; ocular sinus vague; submentum tapering, posterior portion of submentum of medium width, sides parallel; antennal segments 5–10 serrate.

Pronotum: Subrectangular, transverse, base about same width as apex; disk with surrounding, impressed, marginal line; lateral carina complete, extending from base to apex; prosternum with long, slender process that completely separates procoxae; mesosternum with long process, not cleft.

Scutellum: Quadrate, not truncate apically.

Elytron: Oval, approximately two times longer than wide, females with glabrous field near humerus between striae 9 and 10.

Hind femur: Incrassate, oval; dorsal surface not granulate; ventral surface pectinate; prepectenar ridge long, with spines, without protuberances, pecten with spines, first spine usually acuminate, located beyond middle of femur, usually slightly larger than remaining spines; when leg flexed, tibia positioned on lateral side of pecten (Figs. 2, 15); hind tibia arcuate; three strong, ventral carinae, middle carina without tubercles or sulci; with lateral carinae, without dorsolateral carinae; with mesal carinae, without dorsomesal carinae; with apical mucro, without apical calcaria.

Male genitalia: (Fig. 111, 112, 113). Median lobe slender, basal hood slender, with ventral valve but without dorsal valve, without sclerites (Fig. 111); lateral lobes confluent, only slightly cleft (Fig. 113).

Discussion.—Decelle (1965) defined *Afroredon* as "species rounded with short transverse pronotum and in some species a glabrous area that is unpunctured and devoid of striae, situated in the region of the humeral callosities". Better characters for separating genera can be found in the key to genera.

The four species of bruchids that fit the characters of *Afroredon* are *A. africanus* Decelle, *A. katanaganus* Decelle, *A. martini* (Pic), and *A. ritchiei* (Pic).

The genera *Afroredon* and *Mimocaryedon* are similar externally in that both have a prosternum that does not completely separate the procoxae (Fig. 17), the apex of the prosternal process is acute (Fig. 17), elytral stria 1 does not bend away from the meson posterior to the apex of the scutellum (Fig. 19, stria only continuing to slightly posterior to apex of scutellum), striae 2 and 9, and striae 3 and 8 not joined at the apex of the elytron (often hard to see under setae), and the lateral carina of the pronotum is complete or incomplete.

They differ in that the body of *Mimocaryedon* is elongate (Fig. 4), the length of abdominal sternum 1 is about the same as the combined length of sterna 2–5, and females are without a glabrous field near the humerus between elytral striae 9 and 10. In *Afroredon* the body is rounded (Fig. 6), the length of abdominal sternum 1 is about 1.5 times the combined length of sterna 2–5, females with a glabrous field ("miroir", Decelle 1965) near the humerus (Fig. 6) between elytral stria 9 and 10.

Overall, the characteristic differences between *Afroredon* and other Caryedontini are the shape of the prosternum and the absence of a medio-basal lobe on the prothorax. In addition, the male genitalia show a departure from the overall shape of those of the *Caryedon* together with an absence of armature in the internal sac. Of interest is the presence of glabrous patches at the base of the intervals between striae 9 and 10 in some of the females.

This genus is widely distributed through Africa with examples from the Congo, Chad, Senegal, Kenya, Uganda, Abyssinia, Tanzania, Kenya, Swaziland, Namibia, South Africa and Tanzania. *Afroredon martini* Pic lives in Madagascar.

KEY TO SPECIES OF *AFROREDON*

[translated and paraphrased from Decelle (1965: 219)]

1. Antennae elongate, eccentric from segment 3, distinctly subpectinate from segment 4 (Fig. 114); black from segment 3; eyes very large and prominent; no striae joined at the apex of the elytra (Fig. 115) *A. ritchiei* (Pic)
- Antennae less elongate, eccentric from segment 4, serrate from segment 5 (Figs. 116, 117), usually with the first 3 segments darker; elytral striae 2 and 9, and 3 and 8 joined at apices (Fig. 6) 2
- 2(1). Elytral pubescence denser on interstices 3, 5, 7, 9, giving elytra a characteristic striated appearance; pronotum less transverse, less than 1.5 times wider than long, with greatest width at base *A. martini* (Pic)
- Elytral pubescence more uniform, not as above; pronotum more transverse, width more than 1.5 times its length, with greatest width at middle; antennae distinctly darker from segment 4 or 5 3
- 3(2). Palpi dark, brownish black; pronotum more transverse, ratio of width to length 9/5; disk of pronotum with two depressions; elytral disk humped; hind femoral pecten with one large spine followed by 12 smaller spines *A. katanaganus* Decelle
- Palpi brownish-red; ratio of width to length of pronotum 8/5; disks of pronotum and elytra regularly convex; hind femoral pecten with one large spine followed by 9 or 10 smaller spines (Figs. 2, 15) *A. africanus* Decelle

Afroredon africanus Decelle

Figs. 2, 6, 15, 16, 18, 112, 113, 117

Afroredon africanus Decelle 1965: 220 (Holotype ♂: Tchad: N'Gouri, district de Kanem; MRAC); Decelle 1968: 419; Zampetti 1988: 107; Udayagiri & Wadhi 1989: 226.

Description.—*General facies:* Integument fusco-rufous to fusco-piceous; pubescence of uniform, coarse, silver setae; see Fig. 6. Length 3.0–4.5 mm.

Head: Fusco-rufous with fine silver pubescence, median carina present, prominent eyes set fairly close together, distance between eyes slightly less than length of antennal segment 1, eyes coarsely faceted; antenna with segments 1–3 rounded, 4 very slightly serrate, 5–10 serrate, segments slightly broader than long, segment 11 unevenly acuminate; basal segments and apical lighter in color in example examined.

Pronotum: Transverse with lateral margins straight except for acutely conical apex, integument fusco-rufous to fusco-piceous, surface covered with large, unevenly-spaced punctures; pubescence of sparse, coarse, silver setae.

Scutellum: Triangular, longer than broad, with rounded apex, thickly covered with long white setae.

Meso- and Metathorax: Elytra together as long as broad, apex narrow, rounded; integument fusco-rufous to very dark fuscous, pubescence of coarse, silver setae; female with elongate glabrous patch at base of interstices, between striae 9 and 10; legs 1 and 2 fusco-testaceous, hind leg fusco-rufous; hind femur broad with serrations of prepectenar ridge, if present, barely visible, first spine of pecten long, followed by 8 smaller spines (Figs. 2, 15).

Pygidium: Almost twice as broad as long, lateral margins almost straight, converging strongly toward rounded apex; integument fusco-rufous, with silver pubescence.

Male genitalia: (Figs. 112, 113). Median lobe narrow, slightly elongate; ventral valve with straight to slightly concave lateral margins, gently curving to acuminate apex; internal sac devoid of armature; lateral lobes elongate, broadened at apices, cleft to 0.1 their length, apices rounded, with many well-developed setae (Fig. 113).

Female genitalia: Unknown.

Host Plants.—Unknown.

Distribution.—Tchad. Senegal, Uganda, Abyssinia (Decelle 1965: 220). Swaziland, Namibia, Tanzania, South Africa (Decelle 1968: 419). Kenya (Zampetti 1988: 107). W. Darfur, Sudan (BJS).

Discussion.—The four species of *Afroredon* differ from each other in several ways. *Afroredon ritchiei* has elongate antennae that are sub-pectinate and black from segment 4 continuing to apex (Fig. 114) while the other three species have shorter, non-pectinate antennae (Decelle 1965). *Afroredon martini* has very dense pubescence on striae intervals 3, 5, 7, and 9 which is distinctive from the uniform elytral pubescence of *A. katanganus* and *A. africanus*. *Afroredon katanganus* has brownish-black palpi, the pronotum has a width to length ratio of 9/5, the disk of the pronotum has two depressions, and the pecten of the hind femur has a large spine followed by 12 smaller spines. *Afroredon africanus* has brownish-red palpi, a pronotum width to length ratio of 8/5, the disk of the pronotum is regularly convex, and the pecten of the hind femur has a large spine followed by 9 or 10 smaller spines.

Afroredon katanganus Decelle

Figs. 116, 118–120

Afroredon katanganus Decelle 1965: 221 (Holotype ♂: Congo-Léo: Lualaba; MRAC); Zampetti 1988: 108; Udayagiri & Wadhi 1989: 226.

Description.—Translated and paraphrased from Decelle (1965: 221). *General facies:* Head brownish black, very pale in front with brownish-black palpi; with large brown eyes; coloration of elytra dark brownish red with some darker areas; pubescence uniform, fairly dense, very short on 2 oblique bands, very dark in their posterior 0.25. Length 6.5 mm.

Head: Brownish black, very pale in front with brownish-black palpi; with large brown eyes; antennal segments 1 and 3 longer than broad, 2 about as long as broad, segments 4–10 serrate, segments 4, 9 and 10 scarcely serrate, 11 elongate (Fig. 116), segments 1–3 brownish black, segments 4–11 black.

Pronotum: Very transverse, width/length ratio 9/5, greatest width before middle; depressions on either side of midline of disk prevent disk of pronotum from being convex; coloration dark

brown with some scattered, darker areas; doubly punctate, of average density; pubescence quite uniformly dense.

Scutellum: Wider than long, densely pubescent.

Meso- and Metathorax: Elytral convexity irregular, surface slightly fasciculated; coloration dark brownish red with some darker areas; pubescence uniform, fairly dense, very short on 2 oblique bands, very dark in their posterior 0.25; striae 2 and 9, 3 and 8 joined at their apices; legs brown with femur, especially of hind legs, smoky; hind femur with prepectenar ridge of many small tubercles, pecten with large spine followed by 12 smaller spines (Fig. 118).

Pygidium: Much wider than long, moderately convex, brown with disk black, pubescence uniform; underside of abdomen dark, more brown basolaterally.

Male genitalia: (Figs. 119, 120). Ventral valve with slightly concave lateral margins gently rounded to an acuminate apex; lateral lobes narrow, elongate, expanded at apices, lobes rounded apically, cleft to about 0.1 their length, with short setae on apices, basal piece with some short spines (Fig. 120).

Female. Unknown.

Host Plants.—Unknown.

Distribution.—Congo. Kenya (Zampetti 1988: 108).

Discussion.—See *A. africanus* for a discussion of *A. katanganus*.

Afroredon martini (Pic)

Figs. 121, 122

Caryoborus martini Pic 1898b: 371 (Holotype: Diego Suarez, Madagascar; MNHN).

Pachymerus martini: Pic 1913: 8.

Afroredon martini: Decelle 1965: 223, 1968: 419; Udayagiri & Wadhi 1989: 226.

Description.—*General facies*: Integument fusco-rufous, fusco-piceous on lateral margins of elytra, with medial patch on thorax, pubescence alternately long and short on elytra producing a striped effect. Length 2.5–3.5 mm.

Head: Integument fusco-rufous, with clypeus, basal area behind eyes and antenna fusco-testaceous; median carina just visible for anterior part of length of eyes, basal areas consist of a glabrous patch, becoming a shallow groove at extreme

basal end; eyes set widely apart with a well-defined rim, facets large, distance between eyes greater than length of antennal segment 1; segment 1 almost as long as segment 2, segments 1–3 rounded, segment 4 slightly serrate, segments 5–10 strongly serrate, segments slightly broader than long, segment 11 short, slightly unevenly acuminate.

Pronotum: Transverse, basal 0.66 of lateral margins straight, apical 0.33 acutely conical; integument fusco-rufous with median area fusco-piceous; surface glabrous with large, shallow, unevenly spaced punctures, area between punctures covered with minute punctures; pubescence of sparse, fine, silver setae.

Scutellum: Longer than broad, thickly covered with fine white setae.

Meso- and Metathorax: Elytra together slightly longer than broad, strongly narrowed apically, apex slightly truncated; female with glabrous area at base of interstices 9–10; integument fusco-rufous with fusco-piceous area extending from humeral callosities apically including interstices 6, 7 and 8; pubescence of fine, silver-white setae, thicker on interstices 1, 3, 5, 7 and 9 giving a striped effect; legs 1 and 2 fusco-testaceous, hind leg fusco-rufous with pitchy area along middle of hind femur; hind femur with prepectenar ridge with very few small serrations, first spine of pecten slightly larger than 10 smaller spines of pecten.

Pygidium: Male broader than long, lateral margins straight strongly narrow to apex, which is evenly rounded; integument fusco-testaceous with sparse silver pubescence.

Male genitalia: (Figs. 121, 122). Lateral margins of ventral valve slightly concave, gently rounded to acuminate apex; lateral lobes with apices truncated, cleft to 0.25 their length, with many apical setae (Fig. 122).

Female genitalia: Unknown.

Host Plants.—Unknown.

Distribution.—Madagascar.

Discussion.—See *A. africanus* for a discussion of *A. martini*.

Afroredon ritchiei (Pic)

Figs. 114, 115, 123, 124

Pachymerus ritchiei Pic 1928: 297 (Holotype ♂: Tanganyika Territory; BMNH).

Caryedon ritchiei: Decelle 1951: 189.

Afroredon ritchiei: Decelle 1968: 419; Udayagiri & Wadhi 1989: 227.

A. serratus Decelle 1965: 222 (Holotype ♂: ex Deutsch Ost Afrika; ZMB); Decelle 1968: 419; Wendt 1978: 362; Udayagiri & Wadhi 1989: 227.

Description.—*General facies*: Integument fusco-rufous to fusco-piceous overlaid with short, coarse, pale golden pubescence. Length 6.5 mm.

Head: Dark fusco-rufous integument, sparsely overlaid with fine silver pubescence; eyes composed of large facets, set fairly widely apart, median carina present, prominent at anterior end; distance between eyes almost equal to length of antennal segment 1; antenna with segments 1–3 rounded, segment 1 twice as long as segment 2, segment 3 of small diameter, almost as long as segments 1–2, segments 4–10 strongly serrate, each segment as broad as long, segment 11 obliquely angled; entire antenna fusco-piceous.

Pronotum: Transverse, lateral margins straight, except for extreme anterior portion which is obliquely conical; integument of mixed fusco-rufous and fusco-piceous areas; surface with large shallow punctures unevenly spaced, overlaid with sparse, very pale, golden pubescence.

Scutellum: As broad as long, thickly covered with pale golden pubescence.

Meso- and Metathorax: Elytra together only slightly longer than broad, apices rounded, basal end of interstice between striae 9 and 10 with glabrous areas; integument of mixed fusco-rufous and fusco-piceous areas, with main concentration of dark area in mediolateral region of each elytron and basal end of suture; pubescence of short, coarse golden setae sparsely deposited, striae deep, well defined; legs fusco-piceous; hind femur short and almost as broad as long, prepectenar ridge serrate, pecten with large first spine and several smaller spines.

Pygidium: As broad as long in female with lateral margins straight, converging toward a narrowly rounded apex, integument mottled with light and dark areas and overlaid with pale golden pubescence.

Male genitalia: (Figs. 123, 124). Ventral valve with lateral margins straight, apex acuminate; lateral lobes broadly cleft to about 0.1 their length, with many, elongate setae at apices (Fig. 124).

Female genitalia: Unknown.

Host Plants.—Unknown.

Distribution.—Tanzania, Uganda (Decelle 1968).

Discussion.—See *A. africanus* for a discussion of *A. ritchiei*. Pic (1928) described this species as *Pachymerus ritchiei*. Decelle (1965) subsequently described it as *Afroredon serratus*. Later, however, Decelle (1968) synonymized *A. serratus* with *P. ritchiei*.

An erroneous report of a host plant for this species that is of interest is that of Decelle (1951). In our copies of the reprints of Decelle's (1951) paper Decelle crossed out the name *Caryedon ritchiei* and replaced it in ink with the name *C. gonagra* F. Therefore, we consider this to be an error that Decelle attempted to correct after publication, and he knew that he had not studied *Afroredon ritchiei* but rather *C. gonagra*. In the same paper Decelle published that his "*Caryedon ritchiei*" was "dans graines de << kao >> (?)" and that the specimens he examined were accompanied by their white nymphal cocoons. BJS was able to establish that "kao" is a vernacular name for *Piliostigma (Bauhinia) thonningii* (Schum.). Prevett (1965, 1967a) published that *C. gonagra* feeds in seeds of *Piliostigma thonningii*. This plant has been reported several times in the literature as a host for species of *Caryedon*. The names of these *Caryedon* are either *C. serratus* or synonyms of *C. cassiae* or *C. serratus*. For these reasons, we do not consider "kao" a valid host for *A. ritchiei*.

GENUS CARYOTRYPES DECELLE

Caryotrypes Decelle 1968: 419. Type species: *Pachymerus pandani* Blanchard, 1845a, by monotypy. Decelle (1968) incorrectly used the name *Caryotrypes pandani* (Blanchard) as the name of the type species; Nilsson & Johnson 1993: 11; Anton 1999: 60.

We did not study specimens of this genus but gathered information from the literature to make a more complete review of the tribe. Therefore, this description is translated and paraphrased from Decelle (1968), Nilsson & Johnson (1993), and Anton (1999).

Description.—*General facies*: Elongate beetles (Fig. 5).

Head: Of moderate length, constricted behind eyes; at least frons with median carina; eyes strongly bulging, ocular sinus and postocular lobe short; antenna long, indistinctly sexually dimorphic; antennal segments 1–3 cylindrical and

slender, 4 subserrate and slender, 5–10 serrate and broader than 1–4, segment 11 oblong-oval.

Pronotum: Subrectangular, apical 0.33 to 0.5 wider than basal end, disk with surrounding impressed marginal line; lateral carina complete; disc from convex at apex to flat at base; front edge depressed; prosternum with short process, not completely separating procoxae.

Elytron: Very elongate; elytral disc flattened, becoming steadily convex towards apex; humeral calli distinct, smooth; lateral margins feebly convex; striae setate, sometimes elytral striae 2 and 3 as well as 4 and 5 coalesced at base.

Thorax: Process on metasternum narrow, acute; hind femur strongly incrassate, pectinate on ventral surface with small spines and tubercles on prepectenar ridge, pecten with one large spine followed by 9–15 gradually smaller spines; when leg flexed, tibia positioned on lateral side of pecten; hind tibia arcuate, with lateral, lateroventral, mesoventral and dorsomesal carinae, with large mucro.

Abdomen: Simple; pygidium vertical.

Male genitalia: (Figs. 126, 127). Median lobe short; ventral valve triangular, elongate, flat, apex acuminate; internal sac with pair of chain-like

sclerites in basal 0.33 and several pairs of denticle-like sclerites in middle 0.33; tegmen with lateral lobes simple, short, with medial cleft to less than 0.5 their length; apices with several long setae; tegminal strut with large, keel-like median carina (Figs. 126, 127).

Discussion.—*Caryotrypes* is near *Caryedon* because they share the unique character of having the prosternum not completely separating the procoxae (Fig. 17), the apex of the prosternal process is acute (Fig. 17), elytral stria 1 does not bend away from the meson posterior to the apex of the scutellum (Fig. 19, stria only continuing to slightly posterior to scutellum apex), striae 2 and 9, and striae 3 and 8 not joined at the apex of the elytron (often hard to see under setae). The two genera differ in that in *Caryotrypes*, the lateral carina of the pronotum is complete, extending from base to apex, and the body is elongate (Fig. 5). In *Caryedon*, the lateral carina of the pronotum is incomplete (Fig. 20) but strong at the base, tapering, and obsolete at the apex, and the body is more oval (Fig. 3).

The two species that fit the definition of *Caryotrypes* are *C. pandani* and *C. minor*.

KEY TO SPECIES OF CARYOTRYPES

1. Size larger, length (pronotum–elytra) 5.2 to 8.8 mm, width (at mid-length of the pronotum) 2.3 to 3.9 mm; pecten of hind femur with large first spine followed by 10–12 smaller spines; male genitalia as in Figures 129, 130 *C. pandani* (Blanchard)
- Size smaller, length (pronotum–elytra) 2.4 to 3.4 mm, width 1.0 to 1.5 mm; pecten with large first spine followed by about 13–15 smaller spines; male genitalia as in Figures 126, 127 *C. minor* Anton

Caryotrypes minor Anton

Figs. 125–127

Caryotrypes minor Anton 1999: 60 (Holotype ♂: Thailand, Thap Sake distr.; MHNG).

Description.—Paraphrased from Anton (1999). *General facies*: Color red brown; usually antennal segments 1–4 and legs paler, antennal segments 5–11 and hind legs darkened. Length (pronotum–elytra): 2.4–3.4 mm. Width 1.0–1.5 mm.

Vestiture: Uniform grayish, moderately dense, recumbent, not covering integument completely.

Head: With moderate, dense punctation, frons with sharp, elongate, sometimes shiny, median carina, tapering off at vertex; minimum distance between eyes about combined width of 4 eye facets; ocular sinus about 0.25 eye length.

Pronotum: About 1.3 times wider than long, greatest width at apical 0.33; lateral margins convex in apical 0.66, linear in basal 0.33; base about 1.3 times wider than apex; disc doubly punctured, distances of punctures more or less than their diameter, without shiny welts.

Scutellum: Small, triangular.

Meso- and Metathorax: Elytra about 1.7 times

longer than combined width, with maximum width at basal 0.33; striae strongly impressed, punctures indistinct, distance of punctures more or less than their diameters; strial intervals from weakly convex at base to strongly convex toward apex, with microreticulations; hind femur about twice as long as wide, prepectenar ridge with several very small spines and granulations (Fig. 125), pecten with large first spine followed by about 13–15 smaller spines; mucro about 1.6 times longer than tibial width at apex; hind tarsal segment 1 about as long as remaining segments.

Pygidium: About 1.2 times wider than long; with oblong lateral depression subbasally; with sparser, fine punctation.

Male. Antenna: Extending to about 0.5 length of elytron; antennal segment 1 about 1.6 times longer than 2 and 4, and about 1.3 times longer than 3, segment 5 about 1.2 times longer than wide, 8–10 about 1.6 times longer than wide, 11 about 2.3 times longer than wide.

Abdomen: Sternum 5 emarginate toward base to about 0.6 distance of length; pygidium convex on apical 0.5.

Male genitalia: (Figs. 126, 127): Median lobe elongate, narrow; ventral valve narrow, lateral margins slightly concave, acuminate at apex; dorsal valve elongate, narrow; armature of internal sac with pair of chain-like sclerites consisting of about 13–14 circular segments extending from base to middle, in middle 0.33 with 8–10 pairs of larger sclerites, apical 0.33 of internal sac besides chain-like sclerites with additional row of about 9–10 smaller sclerites (Fig. 126); lateral lobes broad, cleft medially to about 0.25 their length, apices with about 20 setae (Fig. 127).

Female. Antenna extending to about 0.33 length of elytron; antennal segments somewhat shorter and more square than in male, segments 8–10 about 1.2 times wider than long, 11 about 1.5 times longer than wide.

Abdomen: Sternum 5 not emarginate; pygidium weakly convex.

Female genitalia: Ovipositor short; bursa copulatrix with about 20 oblong sclerites arranged in a circle.

Host Plants.—Unknown.

Distribution.—Thailand.

Discussion.—See *C. pandani* for a discussion of this species. Although *C. minor* was described from Thailand, outside the study area, we believe

that it should be included here because there are only two species in the genus.

Caryotrypes pandani (Blanchard)

Figs. 5, 128–130

Pachymerus pandani Blanchard 1845a: 114 (Lectotype ♂: Madagascar; MNHN); Bridwell, 1929: 143.

Bruchus (*Pachymerus*) *pandani*: Blanchard 1845b: IV.

Pseudopachymerus pandani: Pic 1913: 11; Bridwell 1918: 493.

Caryedon? *pandani*: Bridwell 1929: 145.

Caryedon pandani: Zacher 1952: 469.

Caryotrypes pandani: Decelle 1968: 423; Udayagiri & Wadhi 1989: 235; Nilsson & Johnson 1993: 11; Anton 1999: 60.

Description.—Translated and paraphrased from Decelle (1968) and modified according to Anton (1999). *General facies*: Form elongate (Fig. 5), color red brown with scattered darker spots, color of integument masked by fine, dense, uniform pubescence giving a gray appearance to integument. Length (pronotum–elytra): 5.2–8.8 mm. Width 2.3–3.9 mm.

Color: Red brown; usually antennal segments 1–4 and legs paler, antennal segments 5–11 and hind legs darkened.

Vestiture: Uniform grayish, moderately dense, recumbent, not covering integument completely.

Head: With moderate, dense punctation, frons with sharp, elongate, sometimes shiny, median carina, tapering off at vertex; eyes large; minimum distance between eyes about combined width of 4 eye facets; ocular sinus about 0.25 eye length; antenna elongate, segments 5–10 elongate, slightly serrate, segment 11 elongate (Fig. 128).

Pronotum: About 1.3 times wider than long, greatest width at apical 0.33; lateral margins convex in apical 0.66, linear in basal 0.33; base about 1.3 times wider than apex; disc double punctured, distances of punctures more or less than their diameter, without shiny welts (Fig. 5).

Scutellum: Small, triangular, pubescent, punctate.

Meso- and Metathorax: Elytra about 1.7 times longer than combined width, with maximum width at basal 0.33; striae strongly impressed, punctures indistinct, distance of punctures more or less than their diameters; strial intervals flatter than in *C. minor* and from weakly convex at base to strongly convex towards apex, with microretic-

ulations; interstices alutaceous; hind femur about twice as long as wide, prepectenar ridge with several small spines and granulations (Fig. 125), pecten with large first spine followed by about 10–12 smaller spines; mucro about 1.6 times longer than tibial width at apex; first hind tarsal segment about as long as remaining segments.

Pygidium: About 1.2 times wider than long, with oblong lateral depression subbasally, with less dense, fine punctation, densely pubescent.

Male. Antenna: Extending to about 0.5 length of elytron; antennal segment 1 about 1.6 times longer than 2 and 4, and about 1.3 times longer than 3, segment 5 about 1.2 times longer than wide, 8–10 about 1.6 times longer than wide, 11 about 2.3 times longer than wide.

Abdomen: Sternum 5 emarginate towards base to about 0.6 distance of length; pygidium convex on apical 0.5.

Male genitalia: (Figs. 129, 130). Median lobe elongate, broad; ventral valve narrow, lateral margins slightly concave, acuminate at apex, dorsal valve elongate, lateral margins gently convex; armature of internal sac with pair of chain-like sclerites with about 13–14 circular segments extending from base to middle, chain-like sclerites flanked by additional rows of about 9–10 small spines, in middle 0.33 with about 5 smaller sclerites, apical 0.33 with about 4 strongly-sclerotized sclerites; lateral lobes slender, cleft medially to about 0.4 times their length, apices with about 25 setae (Fig. 130).

Female. Antenna: Extending to about 0.33 length of elytron; antennal segments somewhat shorter and more square than in male, 8–10 about 1.2 times wider than long, 11 about 1.5 times longer than wide.

Abdomen: Sternum 5 not emarginate; pygidium weakly convex.

Female genitalia: Ovipositor short; bursa copulatrix with about 20 oblong sclerites arranged in a circle.

Host Plants.—*Old records*: *Pandanus* sp. (Blanchard 1845a, b).

New records: None.

Distribution.—Mascarene Region: Mauritius (uncertain), possibly Réunion or Madagascar.

Discussion.—*Caryotrypes pandani* and *C. minor* are the only two species presently placed in this genus and are very closely related. They differ in that *C. pandani* is larger in both length and width. The length (pronotum–elytra) of *Caryotrypes pan-*

dani is 5.2 to 8.8 mm and its width (at mid-length of the pronotum) is 2.3 to 3.9 mm. The length (pronotum–elytra) of *C. minor* is 2.4 to 3.4 mm and its width is 1.0 to 1.5 mm. The elytral intervals of *C. pandani* are flatter and the pecten of the hind femur has only 10–12 smaller spines. The median lobe of the male genitalia of *C. pandani* is broader (Fig. 129), the middle third of the internal sac has only about 5 denticle-like sclerites, the apical third of the internal sac lacks the chain-like sclerites with an additional row of about 9–10 smaller sclerites, the lateral lobes are more slender, cleft to 0.4 of their length and their apices have about 25 setae (Fig. 130) rather than the 20 of *C. minor* (Fig. 127).

According to Anton (1999), the variability in body size of *C. pandani* is greater than reported in the redescription by Decelle (1968). The length (pronotum–elytra) varies from 5.2 to 8.8 mm and the width from 2.3 to 3.9 mm. Anton (1999) was the first to publish figures of the male genitalia of *C. pandani*.

The host published by Blanchard (1845a, b) is a species in the genus *Pandanus*, in the family Pandanaceae (Decelle 1968: 424). To our knowledge, there have been no reports of *C. pandani* or any other bruchid feeding in seeds of this plant since the report by Blanchard. Therefore, this record needs verification for several reasons. It is the only record of a species of bruchid reported to feed in seeds of this genus. In addition, the type locality of this species is somewhat uncertain which makes the reliability of the host more doubtful. The Pandanaceae are monocotyledonous plants and few bruchid larvae are known to feed in seeds of this plant group. There are many species of Pachymerinae in the New World, however, that feed in seeds of palms (Arecaceae), another monocotyledonous group that is closely related to the Pandanaceae (Takhtajan 1969).

GENUS *EXOCTENOPHORUS* DECELLE

Exoctenophorus Decelle 1968: 413. Type species: *Exoctenophorus deflexicollis*, Decelle 1968, by monotypy; Nilsson & Johnson 1993: 12.

Exoctenophorus deflexicollis Decelle

Figs. 8, 11, 131–135

Exoctenophorus deflexicollis Decelle 1968: 417 (Holotype ♂: Madagascar; MNHN); Udayagiri & Wadhi 1989: 235; Nilsson & Johnson 1993: 12.

Because this genus is monotypic, the combined genus and species description is given below.

Description.—Translated and paraphrased from Decelle (1968) and paraphrased from Nilsson & Johnson (1993). *General facies*: Short, oval beetles, almost as wide as long (Fig. 8); integument light brown, setae sparse, uniformly whitish, area between striae with pubescence of alternating fine and medium textured setae giving an effect of alternating color, so that elytron appears striped. Length 4–5 mm.

Head: Short and broad, constricted behind eye; vertex with diffuse median carina, sometimes partly covered by setae; eye large, feebly bulging, extending to both dorsal and ventral sides of head; ocular sinus vague; submentum tapering, posterior portion wide, subtriangular, converging posteriorly between eye and gena; antenna 0.33 length of body; antennal segments 4–10 serrate, sometimes segment 3 feebly serrate.

Pronotum: Subrectangular to almost subpentagonal, transverse, base wider than apex; disk with surrounding impressed marginal line; lateral carina complete, extending from base to apex; prosternum with short, acute process, only separating procoxae to about 0.25 their length.

Scutellum: Short and broad, trapezoidal, wider basally.

Meso- and Metathorax: Elytron oval, approximately two times longer than pronotum, greatest width at middle; striae well marked, stria 1 curved away from scutellum at base, striae 2 and 9, and 3 and 8 united at apex, stria 10 reaching to about 0.66 length of elytron; interstices convex, alutaceous; mesosternum with long, moderately wide process, not cleft; hind femur incrassate, oval, dorsal surface not granulate; ventral side pectinate; prepectenar ridge short, without spines or protuberances, pecten with first spine located before middle of femur (Fig. 11), acuminate, larger than remaining spines; when leg flexed, tibia positioned on medial side of pecten; hind tibia arcuate, with three strong ventral carinae, middle carina with a tubercle, without sulcus; with lateral and mesal carinae; dorsolateral and dorsomesal carinae obsolete; mucro at apex, with apical calcaria.

Pygidium: Much longer than wide, subvertical.

Male genitalia: (Figs. 131, 132, 133). Median lobe very slender, elongate, without median sclerites, with one complex basal sclerite (Figs. 131, 133), spiculum gastrale Y-shaped, branches short;

lateral lobes confluent, not separated, very slender, with small cleft (Fig. 132).

Female genitalia: (Figs. 134, 135). Elongate, apices of ovipositor with 2 setiferous papillae (Fig. 134), spermatheca with a lateral knob (Fig. 135), spiculum ventrale very elongate.

Host Plants.—Unknown.

Distribution.—Madagascar.

Discussion.—*Exoctenophorus deflexicollis* differs from other genera and species in the Caryedontini by its unique hind leg (Fig. 11). When the hind leg is flexed, the tibia is positioned on the medial side of the pecten, the first spine of the pecten on the femur is not large and acuminate, there are two apical tubercles on the apical side of the pecten, and the tibia has a tubercle close to its base.

This genus and species are known only from Madagascar and its host plant is unknown.

GENUS *MIMOCARYEDON* DECELLE

Mimocaryedon Decelle 1968: 419. Type species: *Mimocaryedon freyi* Decelle 1968, by original designation; Nilsson & Johnson 1993: 11.

Mimocaryedon freyi Decelle

Figs. 3, 136–138

Mimocaryedon freyi Decelle 1968: 421 (Holotype ♀: Tanzania: Manyara; NMB); Udayagiri & Wadhi 1989: 236; Nilsson & Johnson 1993: 11.

Because this genus is monotypic, the combined genus and species description is given below. We did not examine specimens of this genus but rather compiled the following description from the literature.

Description.—This description is translated and paraphrased from Decelle (1968) and Nilsson & Johnson (1993). *General facies*: Elongate beetles with lateral margins of elytra slightly rounded (Fig. 4). Length 7.5 mm.

Head: With longitudinal carina between eyes; eyes large; antennal segments 1 and 2 red, apical 9 black; segments 4–10 serrate, segment 4 much longer than 3 (Fig. 136).

Pronotum: Subrectangular, base wider than apex; lateral carina complete (Fig. 4); prosternum with long process, completely separating procoxae (Fig. 137).

Scutellum: Small, trapezoidal.

Meso- and Metathorax: Elytron elongate, lateral

margins of elytra slightly rounded; without a glabrous field between elytral striae 9 and 10 near humerus; stria 1 originating anterior to apex of scutellum, bending in a direction away from the meson; striae 2 and 9, and striae 3 and 8 united at apex (Fig. 4); process on metasternum wide, rounded; hind femur pectinate on ventral surface, pecten with spines, first spine located beyond middle at posterior 0.4 of femur, slightly larger than other spines; when leg flexed, tibia positioned on lateral side of pecten; hind tibia with carinae, without tubercle.

Pygidium: Wider than long, with two lateral depressions; integument dark; surface alutaceous.

Male genitalia: Unknown.

Female genitalia: (Fig. 138). Spermatheca with two contiguous knobs (Fig. 138).

Host Plants.—Unknown.

Distribution.—Tanzania.

Discussion.—The genera *Mimocaryedon* and *Afroredon* are similar externally in that both have a prosternum that completely separates the procoxae (Fig. 137), the apex of the prosternal process is acute, elytral stria 1 does not bend away from the meson posterior to the apex of the scutellum (Fig. 19), stria only continuing to slightly posterior to apex of scutellum, striae 2 and 9, and striae 3 and 8 do not join at the apex of elytron (often hard to see under setae). *Mimocaryedon* differs from *Afroredon* because the length of abdominal sternum 1 is about the same as the combined length of sterna 2–5, and females are without a glabrous field between elytral striae 9 and 10 near the humerus. In *Afroredon*, the length of abdominal sternum 1 is about 1.5 times the combined length of sterna 2–5; females have a glabrous field ("miroir", Decelle 1965) near the humerus (Fig. 6) between elytral striae 9 and 10.

Mimocaryedon freyi was described by Decelle (1968) from one female from the private collection of G. Frey. After some controversy (see Nilsson & Johnson 1993) regarding the deposition of the material from the former Museum Georg Frey, the type of *M. freyi* is now deposited in the Naturhistorisches Museum Basel, Basel, Switzerland. *Mimocaryedon freyi* is known only from Tanzania and there are no known hosts for this species.

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LITERATURE CITED

- Abdul-Rassoul, M. S. 1990. Chalcidoid (Hymenoptera) parasites of the bruchid beetles in Iraq with a description of a new species. *Bulletin of the Iraq Natural History Museum* 8(3): 7–13.
- Al-Ali, A. H., & A. Z. M. Ali. 1988. New species of legume beetle of genus *Caryedon* (Bruchidae: Coleoptera) from Iraq. *Journal of Biological Sciences Research* 19(1): 1–6. (In Arabic).
- Allard, E. 1895a. Un nouveau Bruchide de Madagascar (Col.). *Bulletin de la Société entomologique de France* 1895: CLIV.
- Allard, E. 1895b. Notes sur les Bruchides recueillis dans l'Inde anglaise. *Annales de la Société entomologique de Belgique* 39: 225–228.
- Anton, K. -W. 1994a. The Bruchidae (Coleoptera) of Oman with descriptions of a new genus and two new species. *Fauna of Saudi Arabia* 14: 105–112.
- Anton, K. -W. 1994b. Familie: Bruchidae pp. 143–151. In Lohse, G. A. & Lucht, W. H. (eds.). *Die Käfer Mitteleuropas*, Band 10; 3. Supplementband mit Katalogteil. Goecke & Evers Verlag, Krefeld, Germany.
- Anton, K-W. 1998. Results of the Czechoslovak-Iranian entomological expeditions to Iran 1970, 1973 and 1977 Coleoptera; Bruchidae. *Casopis Narodniho Muzea Rada Prirodovedna* 167(1–4): 73–90.
- Anton, K-W. 1999. Notes on *Caryotrypes* Decelle, with the description of a new species (Coleoptera: Bruchidae: Pachymerinae). *Genus* 10(1): 59–63.
- Anton, K. -W., J. Halperin, & M. Calderon. 1997. An annotated list of the Bruchidae (Coleoptera) of Israel and adjacent areas. *Israel Journal of Entomology* 31: 59–96.
- Arora, G. L. 1977. Taxonomy of Bruchidae Coleoptera) of northwest India, Part I. Adults. *Oriental Insects*, Supplement No. 7: 1–132.
- Arora, G. L. 1978. Taxonomy of the Bruchidae (Coleoptera) of northwest India Part II. Larvae. *Oriental Insects*, Supplement No. 8: 1–48.
- Arora, G. L. & S. K. Singal. 1978. *Oryza sativa* Linn. (paddy) as a new host record of *Caryedon serratus* (Olivier) (Coleoptera: Bruchidae). *Indian Journal of Entomology* 40: 86.
- Bagdasaryan, B. A. 1941. The seed beetles of the Armenian SSR and their relationships with plants, particularly Leguminosae. *Nauchnii Trud Erevanskii Gosudarskii Universitet* 16: 309–374. (In Russian)
- Bagheri-Zenous, E. 1995. The groundnut seed beetle (*Caryedon palaestinus* South. Coleoptera, Bruchidae), a new pest in Iran. *Iranian Journal of Agricultural Sciences* 25(2): 65–69. (In Arabic)
- Baudi, F. 1886. Rassegna della specie della famiglia dei Milabridi (Bruchidi degli autori) viventi in Europa e regioni finitime. *Naturalista Siciliano* 6(4–5): 1–119.
- Baudi, F. 1887. Mylabridum seu Bruchidum (Lin. Schoen. All.) europae et finitimarum regionum faunae recensio. *Deutsche entomologische Zeitschrift* 31: 441–494.
- Bedel, L. 1901. 3^e Famille. Lariidae [Mylabridae et Bruchidae Auct.]. Pp. 341–366. In *Faune des coléoptères du Bassin de la Seine*. Tome 5. Phytophaga. Société Entomologique de France, Paris. 423 pp.
- Belinsky, A., & J. Kugler. 1978. Observations on the biology and host preference of *Caryedon serratus palaestinus* (Coleoptera: Bruchidae) in Israel. *Israel Journal of Entomology* 12: 19–33.
- Blanchard, C. E. 1845a. *Histoire des insectes, traitant de leurs mœurs et de leurs métamorphoses en général, et comprenant une nouvelle classification fondée sur leurs rapports naturels*. Volume 2. Paris. 524 pp.
- Blanchard, C. E. 1845b. Communications. *Bruchus* (*Pachymerus*) *pandani*. *Annales de la Société Entomologique France* 3(2): IV–V.
- Borowiec, L. 1980. Klucze do oznaczania owadów Polski. *Polskie Towarzystwo Entomologiczne* XIX: 1–51
- Borowiec, L. 1984. The seed-beetles from Turkey (Coleoptera, Bruchidae). *Polskie Pismo Entomologiczne* 54: 295–301.
- Borowiec, L. 1985. New synonym and new distributional data of Palearctic seed-beetles (Coleoptera, Bruchidae). *Polskie Pismo Entomologiczne* 55(1): 205–207.
- Borowiec, L. 1988. Bruchidae—strakowce (Insecta: Coleoptera). *Fauna Polski-Fauna Poloniae*, Tom 11. Polska PWN, Warszawa. 226 pp.
- Borowiec, L. 1990a. New species, new synonyms and new records in the genus *Caryedon* Schönh. (Coleoptera, Bruchidae, Pachymerinae). *Annales Zoologici* 43(19): 373–393.
- Borowiec, L. 1990b. *Caryedon johnei*, a new species from Madagascar (Coleoptera: Bruchidae: Pachymerinae). *Coleopterists Bulletin* 44(1): 60–64.
- Borowiec, L., & K.-W. Anton. 1993. Materials to the knowledge of seed beetles of the Mediterranean Subregion (Coleoptera: Bruchidae). *Annals of the Upper Silesian Museum, Entomology* 4: 99–152.

- Bottimer, L. J. 1968. Notes on Bruchidae of America north of Mexico with a list of world genera. *Canadian Entomologist* 100(10): 1009–1049.
- Bridwell, J.C. 1918. Notes on the Bruchidae and their parasites in the Hawaiian Islands. *Proceedings of the Hawaiian Entomological Society* 3: 465–505.
- Bridwell, J.C. 1919. Some additional notes on Bruchidae and their parasites in the Hawaiian Islands. *Proceedings of the Hawaiian Entomological Society* 4: 15–20.
- Bridwell, J.C. 1920. Insects injurious to the Algaroba feed industry. *Hawaiian Planters' Record* 22: 337–343.
- Bridwell, J. C. 1929. A preliminary generic arrangement of the palm bruchids and allies (Coleoptera) with descriptions of new species. *Proceedings of the Entomological Society of Washington* 31(8): 141–160.
- Bridwell, J.C. 1932. The subfamilies of the Bruchidae (Coleoptera). *Proceedings of the Entomological Society of Washington* 34(6): 100–106.
- Bridwell, J.C. 1934. Note. *Proceedings of the Entomological Society of Washington* 36(8–9): 265–266.
- Bridwell, J.C. 1946. The genera of beetles of the family Bruchidae in America north of Mexico. *Journal of the Washington Academy of Science* 36(2): 52–57.
- Calderon, M. 1962. The Bruchidae of Israel. *Revista Di Parassitologia* 23(3): 207–216.
- Cancela da Fonseca, J. 1956. *Contribuição para o estudo da ecologia de Pachymerus acaciae* Gyll. (Coleoptera, Bruchidae). Estudos, Ensaios e Documentos. XIX. Ministerio do Ultramar, Junta de Investigações do Ultramar. Lisboa. 125 p.
- Cancela da Fonseca, J. 1975. Notes sur le taux intrinsèque d'accroissement naturel de la bruche de l'arachide *Caryedon gonagra* (Fab.) (Coleoptera, Bruchidae). *Extrait de la Terre et la Vie, Revue d'Ecologie Appliquée* 29: 71–76.
- Center, T. D., & C. D. Johnson. 1974. Coevolution of some seed beetles (Coleoptera: Bruchidae) and their hosts. *Ecology* 55: 1096–1103.
- Chujo, M. 1937. Some additions and revisions of Bruchidae from the Japanese Empire. *Transactions of the Natural History Society of Formosa* 27: 189–201.
- Cock, M. J., & H. C. Evans. 1984. Possibilities for biological control of *Cassia tora* and *C. obtusifolia*. *Tropical Pest Management* 30(4): 339–350.
- Davey, P. M. 1958. The groundnut bruchid *Caryedon gonagra* (F.). *Bulletin of Entomological Research* 49: 385–404.
- Decaux, C. 1894. Métamorphoses du *Caryoborus tamarindi* coléoptère de la famille Bruchides. *Le Naturaliste* 16: 128–131.
- Decelle, J. 1951. Contribution a l'étude des Bruchidae du Congo Belge (Col. Phytophaga). *Revue de Zoologie et de Botanique Africaines* 45(1–2): 172–192.
- Decelle, J. 1956. Contribution a l'étude de la faune entomologique du Ruanda-Urundi (Mission P. Basilewsky 1953). XCIX. Coleoptera Bruchidae. *Annales du Musée du Congo Belge, Tervuren* (Ser. 8) Sciences Zoologique 51: 423–426.
- Decelle, J. 1958. Contribution a l'étude des Bruchidae du Congo Belge (Col. Phytophaga) (deuxième note). *Revue de Zoologie et de Botanique Africaines* 58: 75–84.
- Decelle, J. 1960a. Bruchidae (Coleoptera Phytophagoidea). *Exploration du Parc National de la Garamba, Mission H. De Saeger* 18(3): 45–74.
- Decelle, J. 1960b. Bruchidae (Coleoptera Phytophagoidea). *Exploitation du Parc National de L'Upemba, Mission G. F. de Witte* 59(6): 135–143.
- Decelle, J. 1965. *Afroredon*, un nouveau genre afro-malgache de Bruchidae–Caryedini. *Revue de Zoologie et de Botanique Africaines* 71(3–4): 213–224.
- Decelle, J. 1966. *Bruchus serratus* Ol., 1790, espèce-type du genre *Caryedon* Schönherr, 1823. *Revue de Zoologie et de Botanique Africaines* 74: 169–174.
- Decelle, J. 1968. Nouveaux genres et espèces de Caryedontini (Col. Bruchidae Pachymerinae) d'Afrique et de Madagascar. *Bulletin et Annales de la Société royale belge d'Entomologie* 104: 413–426.
- Decelle, J. 1969. Le Parc National du Niokolo-koba (Senegal). Part III. XVII. Coleoptera: Bruchidae. *Mémoires de l'Institut fondamental d'Afrique noire* 84: 287–296.
- Decelle, J. 1970. Coleoptera: Bruchidae, Chapter XII. Pp. 256–266. In *South African Animal Life*. Statens Naturvetenskapliga Forskningsråd, Stockholm.
- Decelle, J. 1973. Contribution à la faune du Congo (Brazzaville). Mission A. Villiers et A. Descarpentries. CVIII. Coléoptères Bruchidae. *Bulletin de l'Institut Fondamental de Afrique Noire* 35A(3): 597–602.
- Decelle, J. 1975. Les coléoptères Bruchides d'Angola. *Publicações culturais da Companhia de Diamantes de Angola* 89: 13–32.
- Decelle, J. 1979a. Insects of Saudi Arabia. Coleoptera: Fam. Bruchidae. *Fauna of Saudi Arabia* 1: 318–330.
- Decelle, J. 1979b. Étude d'une collection de coléoptères bruchides de Somalie. *Monitore Zoologico Italiano*, (NS) Suppl. 12(9): 79–88.
- Decelle, J. & N. Lodos. 1989. Contribution to the study of legume weevils of Turkey (Coleoptera: Bruchidae). *Bulletin et Annales de la Société royale belge d'Entomologie* 125: 163–212.
- Delobel, A. 1989. *Uscana caryedoni* [Hym.: Trichogrammatidae]: Possibilités d'utilisation en lutte biologique contre la bruche de l'arachide, *Caryedon serratus* [Col.: Bruchidae]. *Entomophaga* 34(3): 351–363.
- Delobel, A. 1997. Deux nouvelles espèces de *Caryedon* consommatrices des graines de *Terminalia macroptera* (Combretaceae) au Sénégal (Coleoptera, Bruchidae). *Bulletin de la Société entomologique de France* 102(4): 391–396.
- Delobel, A., G. Couturier, F. Kahn, & J. A. Nilsson. 1995a. Trophic relationships between palms and

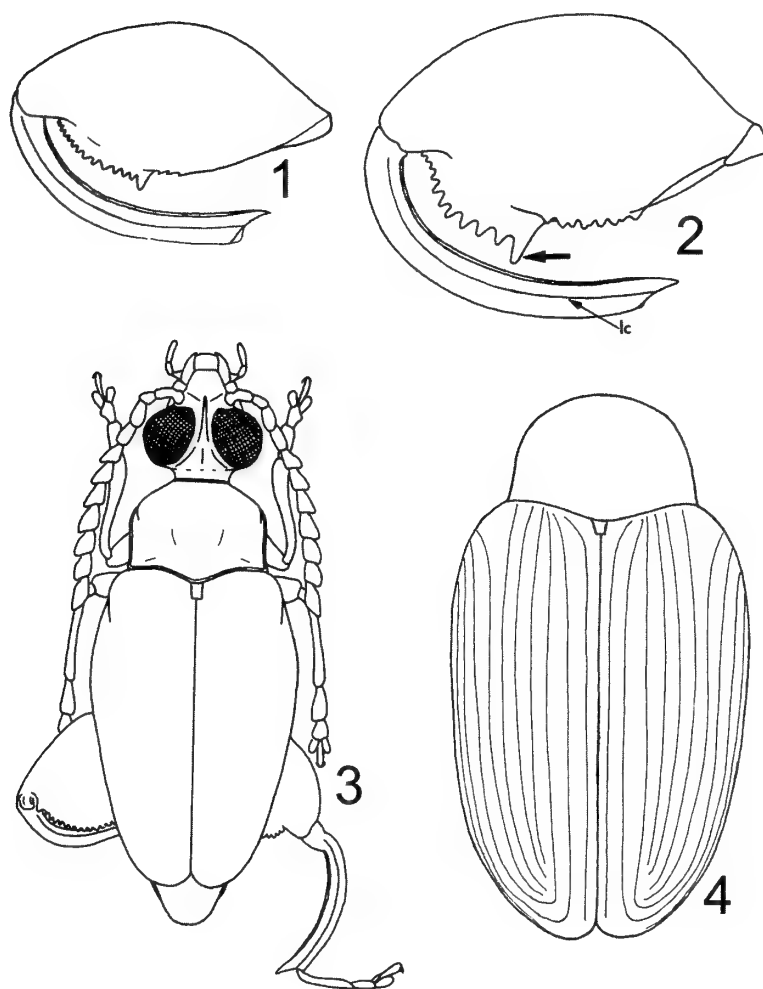
- bruchids (Coleoptera: Bruchidae: Pachymerini) in Peruvian Amazonia. *Amazoniana* 13(3-4): 209-219.
- Delobel, A., H. Delobel, M. Tran, M. Sembène, & S. H. Han. 1995b. Observations sur les relations trophiques entre les bruchides du genre *Caryedon* (Coléoptères, Bruchidae) et leurs plantes hôtes sauvages au Sénégal. *Bulletin de l'Institut Fondamental d'Afrique Noire Cheikh Anta Diop*, Dakar (série A) 48: 79-88.
- Delobel, A., M. Tran, M. Sembène. 2000. Influence du choix alimentaire sur la fécondité et le développement larvaire des *Caryedon* des légumineuses (Coleoptera: Bruchidae) au Sénégal. *Annales de la Société entomologique de France* (N. S.) 36(1): 61-73.
- El Atta, H. A. 1993. The effect of *Caryedon serratus* Olivier (Col., Bruchidae) on viability and germination of seeds of *Acacia nilotica* (L. Willd. Ex Del.) in the Sudan. *Forest Ecology and Management* 57: 169-177.
- Ernst, W. H. O., J. E. Decelle, D. J. Tolsma, & R. A. Verweij. 1990. Lifecycle of the bruchid beetle *Bruchidius uberatus* and its predation of *Acacia nilotica* seeds in a tree savanna in Botswana. *Entomologica Experimentalis et Applicata* 57: 177-190.
- Fabricius, J. C. 1798. *Supplementum Entomologiae Systematicae*, Proft et Storch, Hafniae [=Copenhagen]. 572 pp.
- Fåhraeus, O. J. von. 1871. Coleoptera Caffrariae, annis 1838-1854 a J. A. Wahlberg collecta. Fam. *Brenthidae*, *Anthribidae* et *Bruchidae*, descriptae a Ol. Im. Fåhraeus. *Öfversigt af Königliches Vetenskaps-Akademiens Förhandlingar* 28: 433-452.
- Fairmaire, L. 1885. Liste de coléoptères recueillies a la Terre de Feu par la Mission de la Romanche, et description des espèces nouvelles. *Bulletin et Annales de la Société entomologique de France* 6: 33-62.
- Fairmaire, L. 1902. Matériaux pour la faune coléoptérique Malagache. *Annales de la Société entomologique belge* 46: 236-271.
- Farrell, B., & C. Mitter. 1990. Phylogenesis of insect/plant interactions: Have *Phyllobrotica* leaf beetles (Chrysomelidae) and the Lamiales diversified in parallel? *Evolution* 44: 1389-1403.
- Funk, D. J., D. J. Futuyma, G. Orti & A. Meyer. 1995. A history of host associations and evolutionary diversification for *Ophraella* (Coleoptera: Chrysomelidae): New evidence from mitochondrial DNA. *Evolution* 49: 1008-1017.
- Gillon, Y., J. Y. Rasplus, A. Boughad, & A. M. Mainguet. 1992. Utilisation of seeds of legumes by a population of Bruchidae and Anthribidae (Coleoptera) in a forest-savanna mosaic zone (Lamto: Côte-d'Ivoire). *Revue de Zoologie Africaine* 106(5): 421-443.
- Goeze, J. A. E. 1777. *Entomologische Beyträge zu des Ritter Linné zwölften Ausgabe des Natursystems*. Volume 1. Wiedmann, Leipzig. 736 pp.
- Gozis, M. 1885. Notes et remarques pour le futur catalogue de la faune Gallo-Rhenane. *Revue d'Entomologie* 4: 116-132.
- Halevy, G. 1974. Effects of gazelles and seed beetles (Bruchidae) on germination and establishment of *Acacia* species. *Israel Journal of Botany* 23: 120-126.
- Hamon, C., J. C. Biemont, & G. Chauvin. 1982. Ultrastructure et fonction secrétrice des cellules de la paroi oviductes latéraux chez *Acanthoscelides obtectus* (Coleoptera: Bruchidae). *International Journal of Morphology and Embryology* 11: 327-339.
- Herford, G. M. 1935. A key to the members of the family Bruchidae of economic importance in Europe. *Transactions of British Entomological Society* 2: 1-31.
- Hideux, P. 1984. Possibilités de reproduction et de développement de *Caryedon pallidus* (Coleoptera: Bruchidae) sur *Cassia tora* (Caesalpinaceae). *Acta Oecologica Generalis* 5(4): 327-332.
- Hinckley, A. D. 1960. The klu beetle, *Mimosestes sallaei* Sharp, in Hawaii (Coleoptera: Bruchidae) *Proceedings of the Hawaiian Entomological Society* 17: 260-269.
- Hoffmann, A. 1945. Coléoptères Bruchidae et Anthribides. *Faune de France* 44: 1-184.
- Janzen, D. H. 1969. Seed-eaters versus seed size, number, toxicity, and dispersal. *Evolution* 23: 1-27.
- Johnson, C. D. 1966. *Caryedon gonagra* (Fabricius) established in Mexico (Coleoptera: Bruchidae). *Pan-Pacific Entomologist* 42(2): 162.
- Johnson, C. D. 1970. Biosystematics of the Arizona, California, and Oregon species of the seed beetle genus *Acanthoscelides* Schilsky (Coleoptera: Bruchidae). *University of California Publications in Entomology* 59: 1-116.
- Johnson, C. D. 1981. Seed beetle host specificity and the systematics of the Leguminosae. Pp. 995-1027, + 61 pp. microfiche. In R. M. Polhill & P. H. Raven (eds.). *Advances in Legume Systematics*. Royal Botanic Gardens, Kew. 1050 pp.
- Johnson, C. D. 1981d. Host preferences of *Stator* (Coleoptera: Bruchidae) in non-host seeds. *Environmental Entomology* 10: 857-863.
- Johnson, C. D. 1983a. *Handbook on seed insects of Prosopis species. Ecology, control, and identification of seed-infesting insects of New World Prosopis* (Leguminosae). The Food and Agriculture Organization of the United Nations, Rome. 55 pp.
- Johnson, C. D. 1983b. *Guide des insectes parasites des semences de Prosopis*. Ecologie, moyens de lutte, identification. Organisation des Nations Unies pour l'Alimentation et l'Agriculture, Rome. 64 pp.
- Johnson, C. D. 1983c. *Manual sobre insectos que infestan la semilla de Prosopis*. Ecología, control, e identificación de insectos del Nuevo Mundo que infestan la semilla de *Prosopis* (Leguminosae). Organización de las Naciones Unidas para la Agricultura y la Alimentación. Roma. 59 pp.
- Johnson, C. D. 1985. Potential useful tropical legumes

- and their relationships with bruchid beetles. Pp. 206–210. In K. C. Misra (ed.). *Ecology and Resource Management in Tropics*. Vol. 1. Presented Papers, Silver Jubilee Symposium of International Society for Tropical Ecology. Bhargava Book Depot, Varanasi, India. 324 pp.
- Johnson, C. D. 1994. The enigma of the relationships between seeds, seed beetles, elephants, cattle and other organisms. *Aridus, Bulletin of The Desert Legume Program of the Boyce Thompson Southwestern Arboretum and The University of Arizona* 6(1): 1–4.
- Johnson, C. D. 1986. *Caryedon serratus* (Olivier) (Bruchidae) established in northern South America with additional host and locality records from Mexico. *Coleopterists Bulletin* 40(3): 264.
- Johnson, C. D. & J. M. Kingsolver. 1971. Descriptions, life histories, and ecology of two new species of Bruchidae infesting guacima in Mexico (Coleoptera). *Journal of the Kansas Entomological Society* 44(2): 141–152.
- Johnson, C. D. & J. M. Kingsolver. 1975. Ecology and re-description of the Arizona grape bruchid *Amblycerus vitis* (Coleoptera). *Coleopterists Bulletin* 29(4): 321–331.
- Johnson, C. D. & J. M. Kingsolver. 1981. Checklist of the Bruchidae (Coleoptera) of Canada, United States, Mexico, Central America and the West Indies. *Coleopterists Bulletin* 35(4): 409–422.
- Karapetian, A. P. 1985. Seed-beetles (Bruchidae). P. 72. In: *Fauna Armianskoi SSR (Fauna Armenian SSR) Beetles*. Academy of Science of the Armenian SSR, Yerevan. (In Russian).
- Kaszab, Z. 1967. Zsiksikfélek-Bruchidae. *Fauna Hungariae* 84. 9(7): 1–34. (In Hungarian).
- Kingsolver, J. M. 1962. A note on techniques. *Entomological News* 73(9): 251.
- Kingsolver, J. M. 1968. A new genus of Bruchidae from South America, with the description of a new species. *Proceedings of the Entomological Society of Washington* 70(3): 280–286.
- Kingsolver, J. M. 1970. A study of male genitalia in Bruchidae (Coleoptera). *Proceedings of the Entomological Society of Washington* 72(3): 370–386.
- Kingsolver, J. M. 1992. *Caryedon serratus* (Olivier) new to continental United States (Coleoptera: Bruchidae). *Insecta Mundi* 6(1): 22.
- Kingsolver, J. M., C. D. Johnson, S. R. Swier & A. Terán. 1977. Chapter 6, *Prosopis* fruits as a resource for invertebrates. Pp. 108–122. In B. B. Simpson (ed.). *Mesquite. Its biology in two desert scrub ecosystems*. US/IBP Synthesis Series 4. Dowden, Hutchinson & Ross, Stroudsburg, Pennsylvania. 250 pp.
- Klug, H. 1833. Bericht über eine auf Madagascar veranstaltete Sammlung von Insecten aus der Ordnung Coleoptera. *Abhandlungen der Königlichen Akademie der Wissenschaften zu Berlin* 1832(1): 91–224.
- Küster, H. C. 1845. *Die Käfer Europas: nach der Natur beschrieben / von Dr. H.C. Küster*. Heft 2. Bauer & Raspe, Nürnberg.
- Lienard, V., D. Seck, E. Haubruge, & C. Gaspar. 1992. Biologie de *Caryedon pallidus* (Oliv., 1790) (Col., Bruchidae), ravageur des graines de *Cassia occidentalis* (L.). *Bulletin et Annales de la Société royale belge d'Entomologie* 128(10–12): 339–342.
- Luca, Y. de. 1977. Catalogue des metazoaires parasites et prédateurs des bruchides (Col.) (Troisième Note). *Bulletin de la Société Etude Natural Nîmes* 55: 5–22.
- Luca, Y. de. 1980. Catalogue des metazoaires parasites et prédateurs des bruchides (Col.) (4e Note) (1). *Bulletin de la Société Science Natural Nîmes* 86: 37–55.
- Luk'ianovich, F. K. & M. E. Ter-Minasian. 1957. Zhukizernovki (Bruchidae). *Fauna SSSR. Zhestkokrylye*. Tom XXIV, vyp 1. Akademia Nauk SSSR, Moscow, Leningrad. 208 pp.
- Maes, J.-M. & J. M. Kingsolver. 1991. Catalogo de los Bruchidae (Coleoptera) de Nicaragua. *Revista Nicaraguense de Entomología* 16: 21–34.
- Mathur, R. N., B. Singh, & K. Lal. 1958. Insect pests of flowers, seeds, and fruits of forest trees. *Indian Forestry Bulletin* 223: 1–105.
- Motschulsky, T. V. 1874. Enumeration des nouvelles espèces de Coléoptères rapportées de ses voyages. *Bulletin de la Société impériale des naturalists de Moscou* 46(2): 203–252.
- Mukerji, S. & Chatterjee, S. N. 1951. Morphology of the genital structures of some of the Bruchidae (Lariidae)* of India and Ceylon and their taxonomic importance. *Indian Journal of Entomology* 13(1): 1–28.
- Nilsson, J. A. & C. D. Johnson. 1992. New host, *Bauhinia variegata* L., and new locality records for *Caryedon serratus* (Olivier) in the New World (Coleoptera: Bruchidae: Pachymerinae). *Pan-Pacific Entomologist* 68(1): 62–63.
- Nilsson, J. A. & C. D. Johnson. 1993. A taxonomic revision of the palm bruchids (Pachymerini) and a description of the world genera of Pachymerinae (Coleoptera: Bruchidae: Pachymerinae). *Memoirs of the American Entomological Society*: 41. 1–104.
- Olivier, A. G. 1790. *Bruche, Bruchus*. Pp. 193–202. In Olivier, G. A. (ed.). *Encyclopédie méthodique. Histoire naturelle. Insectes*. Tome Cinquième [part]. Livraison 41. Panckoucke, Paris. 368 pp.
- Pajni, H. R., & T. Singh. 1977. *Caryedon punjabensis* sp. nov. on *Cassia tora* (Coleoptera: Bruchidae). *Oriental Insects* 11(2): 225–228.
- Peake, F. C. G. 1952. On a bruchid seed borer in *Acacia arabica*. *Bulletin of Entomological Research* 43: 317–324.
- Pfaffenberger, G. S. 1984. Description of first instar larva of *Caryedon palaestinus* Southgate, new status (Coleoptera: Bruchidae). *Coleopterists Bulletin* 38(3): 220–226.
- Pfaffenberger, G. S. 1985. Checklist of selected world species of described first and/or final larval instars

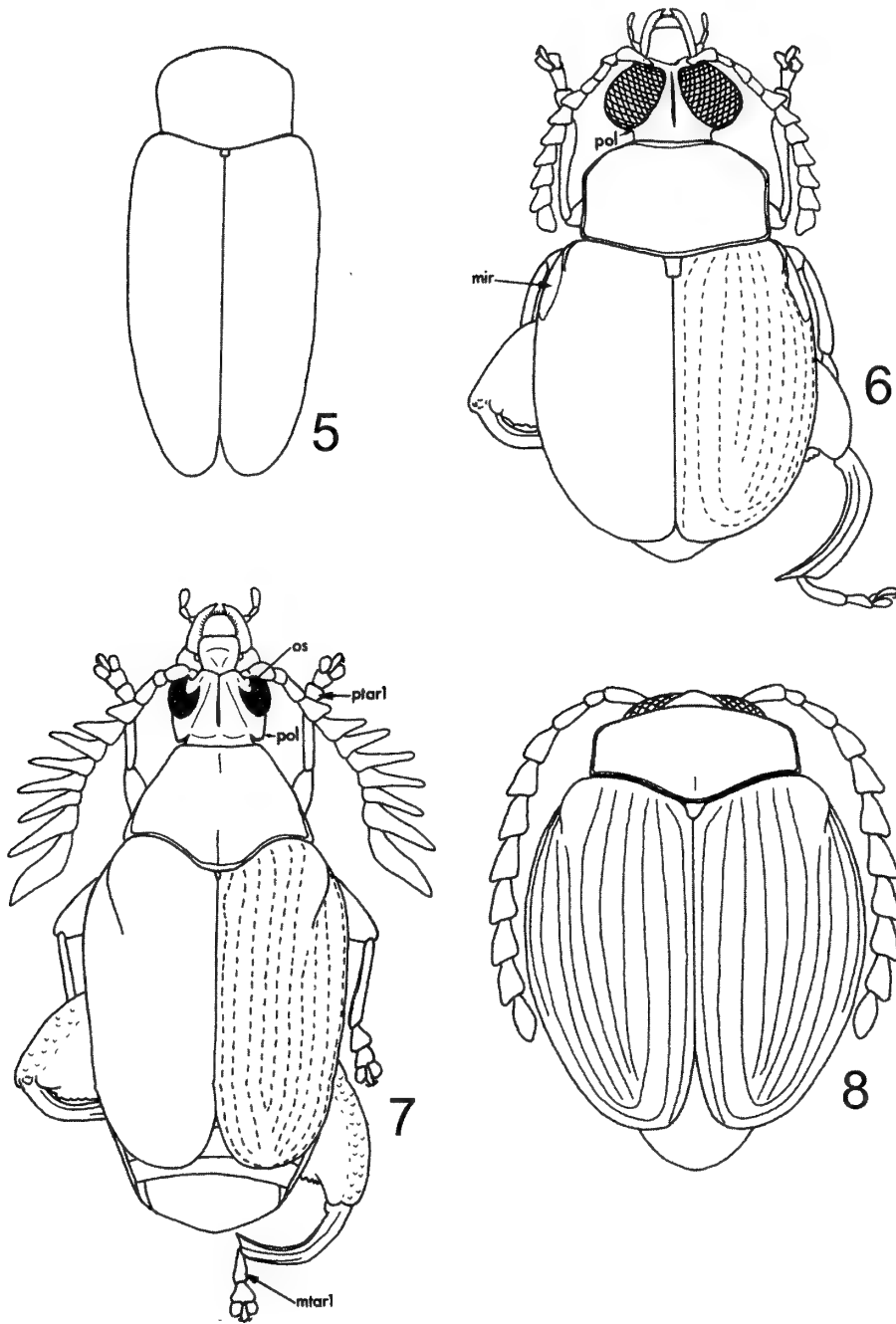
- (Coleoptera: Bruchidae). *Coleopterists Bulletin* 39: 1–6.
- Pfaffenberger, G. S. 1990. A scanning electron microscopic view of the final larval instar of *Zabrotes subfasciatus* (Coleoptera: Bruchidae: Amblycerinae). *Coleopterists Bulletin* 44(1): 37–49.
- Pic, M. 1898a. D'un genre nouveau et de sept coléoptères exotiques. *Bulletin de la Société Zoologique de France* 23: 169–175.
- Pic, M. 1898b. Descriptions de deux *Caryoborus* africains nouveaux. *Bulletin de la Société entomologique de France* 3: 371–372.
- Pic, M. 1902a. Coléoptères nouveaux originaires de la Patagonie. *L'Échange* 18: 49–51.
- Pic, M. 1902b. Coléoptères presumed nouveaux de la Rhodesia. *Revue d'Entomologie* 31(1): 4–7.
- Pic, M. 1902c. Description de Bruchides nouveaux. *Le Naturaliste* 24: 146.
- Pic, M. 1911. Diagnoses préliminaires de 30 coléoptères exotiques. *L'Échange* 27(316): 122–124.
- Pic, M. 1913. Bruchidae. *Coleopterorum Catalogus auspiciis et auxilio W. Junk editus a S. Schenkling*. Pars 55. W. Junk, Berlin. 74 pp.
- Pic, M. 1921. Insectes coléoptères : Rhipidocerides, helodides, malacodermes divers, dermestides, bruchides, monommides, heteromeres (ex parte), hilophilides et anthicides. In *Voyage de M. Guy Babault en Afrique Orientale, 1912–1913. Résultats scientifiques*. Imprimerie Générale Lahure, Paris. 32 pp.
- Pic, M. 1924a. Nouveautés diverses. *Mélanges Exotico-Entomologique* 42: 1–32.
- Pic, M. 1924b. Nouveaux Bruchidae du Congo Belge. *Revue de Zoologie et de Botanique Africaines* 12: 455–460.
- Pic, M. 1928. Nouveaux Bruchidae. *Annals and Magazine of Natural History* (10) XI: 297–299.
- Pic, M. 1932. Coléoptères presumed nouveaux de la Rhodesia. *Revue d'Entomologie* 21: 4–7.
- Pic, M. 1935. Nouveautés diverses. *Mélanges Exotico-Entomologique* 65: 1–36.
- Pic, M. 1950a. Contribution à l'étude de l'air (Mission L. Chopard et A. Villiers). Coléoptères Bruchidae. *Mémoires de l'Institut Français d'Afrique Noire* 10: 211.
- Pic, M. 1950b. Coléoptères du globe. *L'Échange* 66(519): 1–16.
- Poole, R. W., R. E. Lewis, & P. Gentili. 1996. *Nomina Insecta Nearctica. A check list of the insects of North America*. Volume I: Coleoptera, Strepsiptera. Entomological Information Services, Rockville, Maryland. 827 pp.
- Prevett, P. F. 1965. The genus *Caryedon* in northern Nigeria with descriptions of six new species (Col. Bruchidae). *Annales de la Société entomologique de France* (N.S.) I (3): 523–547.
- Prevett, P. F. 1966. Observations on biology in the genus *Caryedon* Schönherr (Coleoptera: Bruchidae) in northern Nigeria, with a list of associated parasitic Hymenoptera. *Proceedings of the Royal Entomological Society of London* 41(1–3): 9–16.
- Prevett, P. F. 1967a. Notes on the biology, food plants and distribution of Nigerian Bruchidae (Coleoptera), with particular reference to the northern region. *Bulletin of the Entomological Society of Nigeria* 1: 3–6.
- Prevett, P. F. 1967b. The field occurrence of *Caryedon serratus* (Ol.), the groundnut seed beetles (Coleoptera, Bruchidae), in Uganda. *Journal of Stored Products Research* 3: 267–268.
- Prevett, P. F. 1967c. The larva of *Caryedon serratus* (Ol.): The groundnut seed beetle (Coleoptera: Bruchidae). *Journal of Stored Products Research* 4: 239–248.
- Prevett, P. F. 1968. The larva of *Pachymerus cardo* (Fabr.), the palm kernel borer (Coleoptera: Bruchidae). *Journal of Stored Products Research* 4: 239–248.
- Prevett, P. F. 1971. The larvae of some Nigerian Bruchidae (Coleoptera). *Transactions of the Royal Entomological Society of London* 123: 247–312.
- Rasplus, J. Y. 1988. La communaute parasitaire des coléoptères seminivores de légumineuses dans une mosaïque forêt-savane en Afrique de l'Ouest (Lamto-Côte d'Ivoire). Thesis, Diplôme de Doctorat, Université de Orsay, Paris XI.
- Ride, W. D. L. (editorial chairman). 1999. *International Code of Zoological Nomenclature*. Fourth Edition. International Commission on Zoological Nomenclature, London. 306 pp.
- Robert, P., J. Huignard, & Y. Nuto. 1982. Host plant changes in several populations of *Caryedon serratus*. P. 323. In *Proceedings of the 5th International Symposium on Insect Plant Relationships*. Wageningen.
- Romero, J., & C. D. Johnson. 2002. *Cassia moschata* H.B.K., new host for *Caryedon serratus* (Olivier) in the New World (Coleoptera: Bruchidae: Pachymerinae) *Coleopterists Bulletin* 56(1): 95–96.
- Schilsky, J. 1905. Bruchidae. In: *Die Käfer Europa's Nach der Natur beschrieben von H. C. Küster und G. Kraatz*. Heft 41. Bauer & Raspe, Nürnberg.
- Schoenherr, C. J. 1823. Curculionides. *Tabula Synoptica Familiae Curculionidum*. *Isis von Oken* 2: 1132–1146.
- Schoenherr, C. J. 1833. *Genera et species Curculionidum, cum synonymia hujus familiae*. Tomus primus–Pars Prima. Roret, Parisiis (Paris, France). 1–381.
- Schoenherr, C. J. 1839. *Genera et species Curculionidum, cum synonymia hujus familiae*. Tomus Quintus–Pars Prima. Supplementum continens. Roret, Parisiis (Paris, France) and Fred. Fleischer, Lipsiae (Leipzig, Germany). 456 pp.
- Sembène, M., & A. Delobel. 1996. Identification morphométrique de populations soudano-sahéliennes de bruche de l'arachide, *Caryedon serratus* (Olivier) (Coleoptera: Bruchidae). *Journal of African Zoology* 110(5): 357–366.
- Sembène, Mbacké, & A. Delobel. 1998. Genetic differen-

- tiation of groundnut seed-beetle populations in Senegal. *Entomologica Experimentalis et Applicata* 87: 171–180.
- Sharp, D., & F. Muir. 1912. The comparative anatomy of the male genital tube in Coleoptera. *Transactions of the Royal Entomological Society of London* 1912 (3): 477–642.
- Shomar, N. F. H. 1963. A monographic revision of the Bruchidae of Egypt (U. A. R.). *Bulletin de la Société entomologique d'Égypte* 47: 141–196.
- Silvain, J.-F., & A. Delobel. 1998. Phylogeny of West African *Caryedon* (Coleoptera: Bruchidae): Congruence between molecular and morphological data. *Molecular Phylogenetics and Evolution* 9(3): 533–541.
- Singal, S. K. & O. P. Toky. 1989. *Pongamia pinnata* (L.) Pierre: a new record of *Caryedon serratus* (Olivier) (Bruchidae: Coleoptera) from India. *Research and Development Reporter* 6(2): 91–92.
- Singh, T. 1973. A comparative study of the female reproductive organs in Bruchidae (Coleoptera) with a consideration of their bearing on classification. *Research Bulletin of the Panjab University (Science)* 14: 67–75.
- Singh, T. 1978. The male accessory glands in Bruchidae (Coleoptera) and their taxonomic significance. *Entomologica Scandinavica* 9(3): 198–203.
- Skaife, S. H. 1926. The bionomics of the Bruchidae. *South African Journal of Science* 23: 575–588.
- Smith, S. G., & J. H. Brower. 1974. Chromosome numbers of stored-product Coleoptera. *Journal of the Kansas Entomological Society* 47: 317–328.
- Southgate, B. J. 1971. On the identity of *Caryedon pallidus* (Olivier) (Col., Bruchidae), and the description of two new *Caryedon* spp. *Bulletin of Entomological Research* 60: 409–414.
- Southgate, B. J. 1976. A new subspecies of *Caryedon* (Coleoptera: Bruchidae) from the Middle East. *Israel Journal of Zoology* 25: 194–198.
- Southgate, B. J. 1978. The importance of the Bruchidae as pests of grain legumes, their distribution & control. Pp. 219–229. In Singh, S. R., H. F. van Emden & T. Ajibola Taylor (eds.). *Pests of Grain Legumes: Ecology and Control*. Academic Press, London. 454 pp.
- Southgate, B. J. 1979. Biology of the Bruchidae. *Annual Review of Entomology* 24: 449–473.
- Southgate, B. J. & R. D. Pope. 1957. The groundnut seed beetle. A study of its identity and taxonomic position. *Annals and Magazine of Natural History* (12)10: 669–672.
- Stebbing, E. P. 1914. *Indian Forest Insects of Economic Importance*. Coleoptera. Eyre & Spottiswoode, London. 648 pp.
- Swezey, O. H. 1925. Note. *Proceedings of the Hawaiian Entomological Society* 6(1): 3.
- Takhtajan, A. 1969. *Flowering Plants Origin and Dispersal*. Smithsonian Institution Press, Washington, D.C. 310 pp.
- Terán, A. L. 1967. Consideraciones sobre *Eubaptus palliatus* Lac., *Bruchus scapularis* Pic y descripción de los estados preimaginales de *Eubaptus rufithorax* (Pic). *Acta Zoologica Lilloana* 21: 71–89.
- Thunberg, C. P. 1805. [Four new genera, in German (no title)]. *Göttingische gelehrte Anzeigen* 29: 281–282.
- Torre-Bueno, J. R. de la. 1989. *The Torre-Bueno Glossary of Entomology* (revised edition). The New York Entomological Society, New York. 840 pp.
- Udayagiri, S. & S. R. Wadhi. 1989. Catalog of Bruchidae. *Memoirs of the American Entomological Institute* 45: 1–301.
- Van Tonder, S. J. 1985. Annotated records of southern African Bruchidae (Coleoptera) associated with acacias, with a description of a new species. *Phytophylactica* 17: 143–148.
- Vats, L. K. 1973a. The malpighian tubules in the larvae of the family Bruchidae (Coleoptera). *Indian Biology* 5: 79–81.
- Vats, L. K. 1973b. Taxonomic values of anatomical characters in bruchid larvae (Bruchidae: Coleoptera). *Research Bulletin (N.S.) of the Panjab University* 24(III–IV): 167–169.
- Vats, L. K. 1976. Alimentary canal in bruchid larvae (Bruchidae: Coleoptera). *Research Bulletin of the Panjab University (Science)* 27: 103–106.
- Vazirani, T. G. 1975. A contribution to the knowledge of Oriental Bruchidae. *Journal of the Bombay Natural History Society* 72(3): 740–757.
- Vélez Angel, Raúl. 1972. Tres plagas insectiles recientemente detectadas en Antioquia. *Revista Facultad Nacional de Agronomía (Medellín, Colombia)* 27(2): 71–74.
- Verma, B. R. 1989. Observations on three parasites of bruchids on leguminous host plants. *Bulletin of Entomology* 30(2): 246–247.
- Verma, B. R. 1993. Observations on three parasites of bruchids on leguminous host plants. *Indian Journal of Entomology* 55(3): 328–329.
- Ward, C. R., C. W. O'Brien, L. B. O'Brien, D. E. Foster, & E. W. Huddleston. 1977. Annotated checklist of New World insects associated with *Prosopis* (mesquite). U. S. Department of Agriculture Technical Bulletin 1557: 1–115.
- Wendt, H. 1978. Der Bruchiden-Typen der Koleopteran-Sammlung des Zoologischen Museums Berlin. *Mitteilungen aus dem Zoologischen Museum in Berlin* 54: 353–367.
- Wendt, H. 1986. Beiträge zur Insektenfauna der DDR: Coleoptera-Bruchidae (Chrysomeloidea). I. Zur Biologie und Verbreitung. *Mitteilungen aus dem Zoologischen Museum in Berlin* 62: 103–133.
- Wendt, H. 1988. Beiträge zur Insektenfauna der DDR: Coleoptera-Bruchidae (Chrysomeloidea). II. Bestimmungstabellen der heimischen Arten. *Mitteilungen aus dem Zoologischen Museum in Berlin* 64: 311–318.

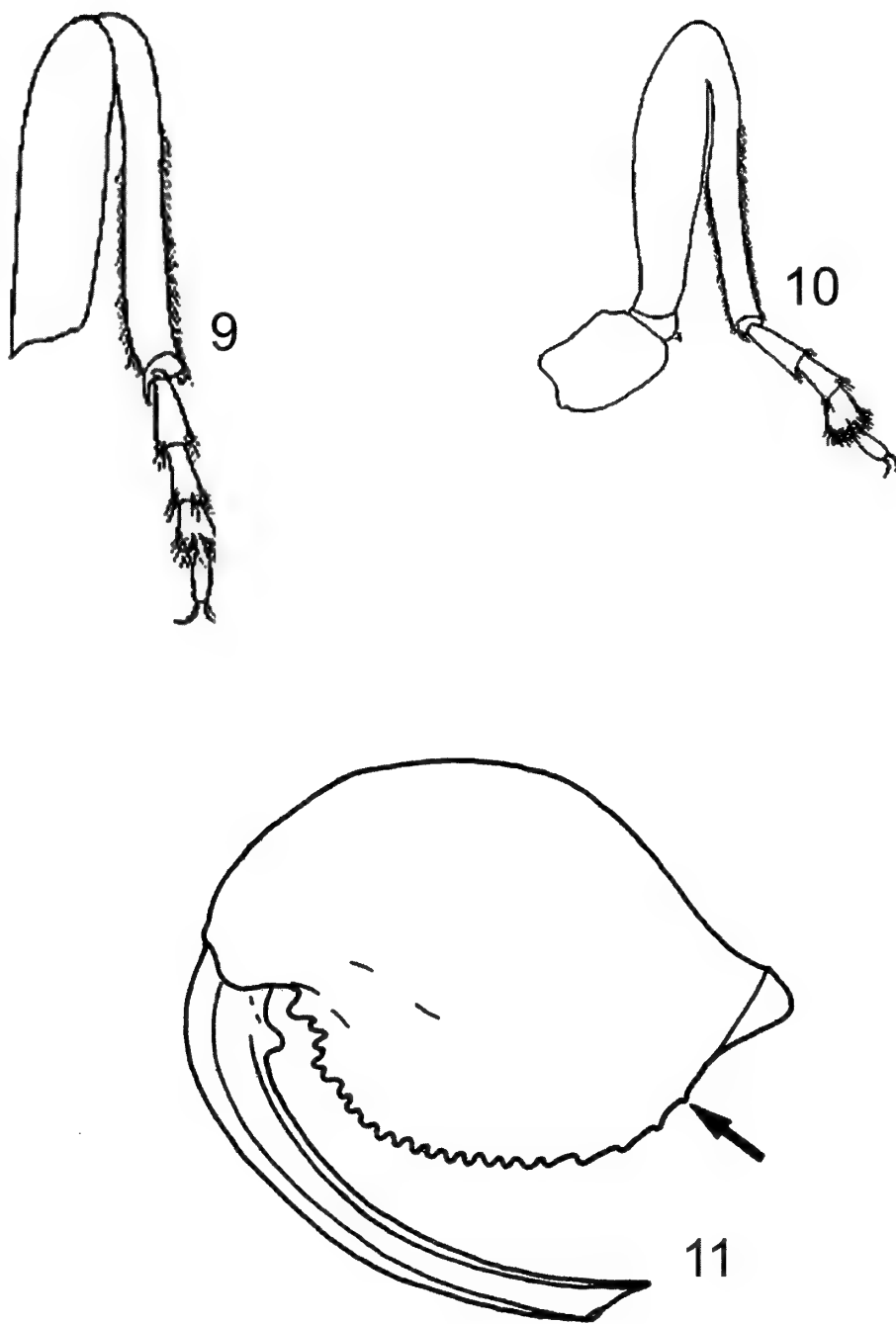
- Yucel, A. 1994. A new species for Turkish fauna: *Caryedon palaestinus* Southgate (Coleoptera, Bruchidae, Pachymerinae). *Turkiye Entomoloji Dergisi* 18(1): 35–39.
- Yus Ramos, R. 1976. Las especies de brúquidos (gorgojos de las leguminosas) de interés agrícola y fitosanitario (Col. Bruchidae) II: Sistemática y biología. *Boletín de Servicios de Plagas* 2: 161–203.
- Zacher, F. 1936. Beiträge zur Nährpflanzenkenntnis der Samenkäfer (Col. Bruch.-Lariidae). *Mitteilungen der Deutschen Entomologischen Gesellschaft* 7(1): 10–13.
- Zacher, F. 1952. Die Nährpflanzen der Samenkäfer. *Zeitschrift für Angewandte Entomologie* 33(3): 460–480.
- Zampetti, M. F. 1984. Contributo alla conoscenza dei bruchidi di Turchia. II. (Coleoptera, Bruchidae). *Fragmenta Entomologica* 17: 395–404.
- Zampetti, M. F. 1988. Appunti sui bruchidi dell'Africa orientale. *Fragmenta Entomologica* Roma 21(1): 101–110.



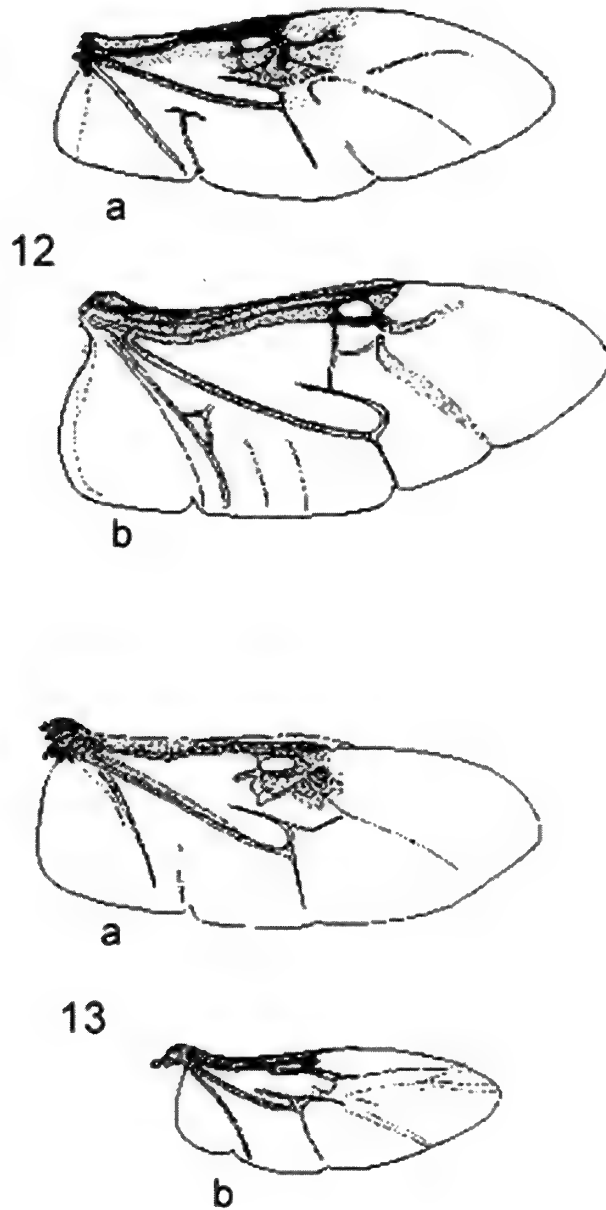
Figs. 1–4. 1, *Caryedon serratus*, hind leg, lateral view; 2, *Afroredon africanus*, hind leg, lateral view; arrow: spine 1 of pecten; lc: lateral carina; 3, *Caryedon serratus*, dorsal aspect; 4, *Mimocaryedon freyi*, dorsal aspect.



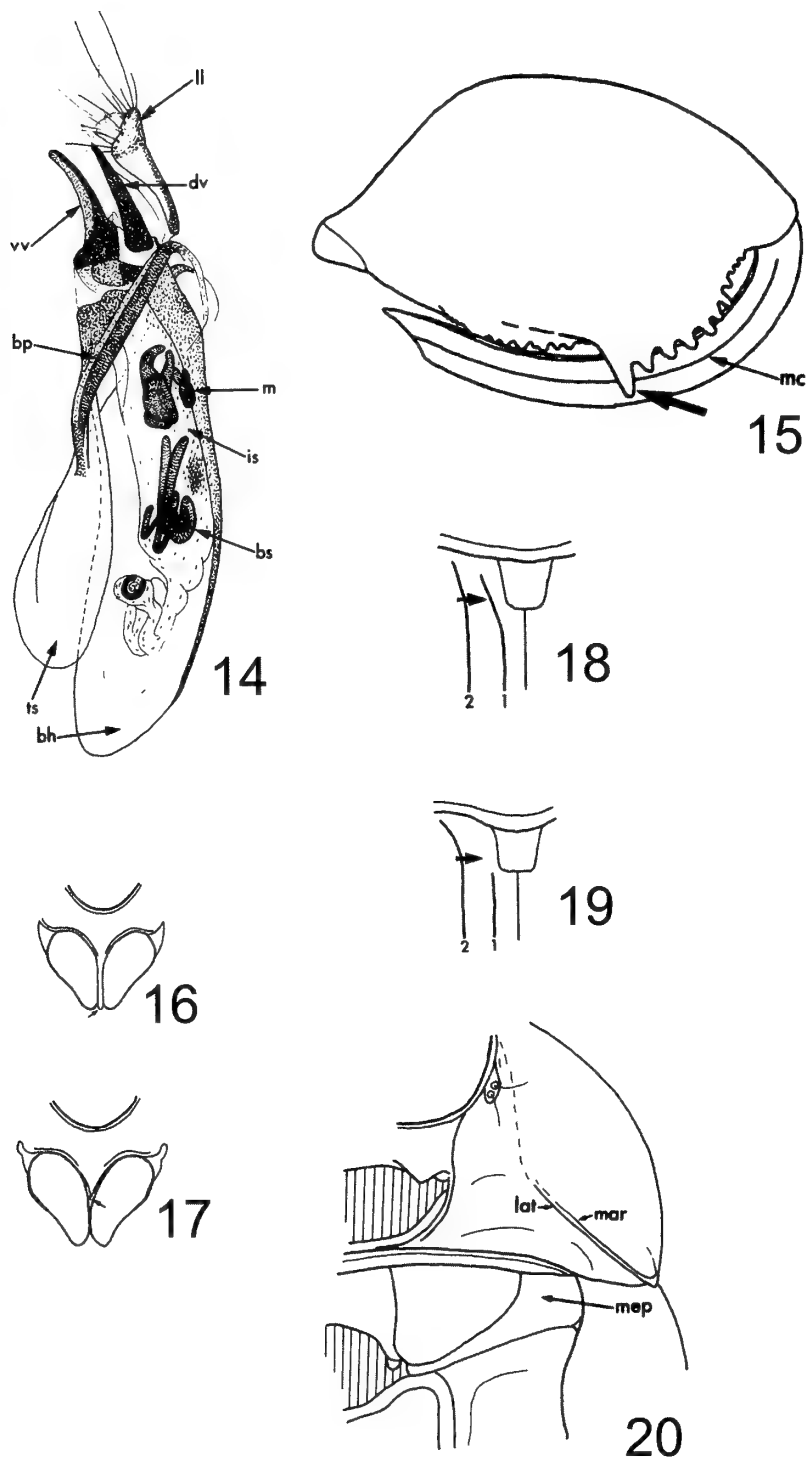
Figs. 5–8. 5, *Caryotrypes pandani*, dorsal aspect; 6, *Afroredon africanus*, dorsal aspect; mir: miroir; pol: postocular lobe; 7, *Caryopemon giganteus*, dorsal aspect; mtar: segment 1 of metatarsus; os: ocular sinus; pol: postocular lobe; ptar 1: segment 1 of protarsus; 8, *Exoctenophorus deflexicollis*, dorsal aspect.



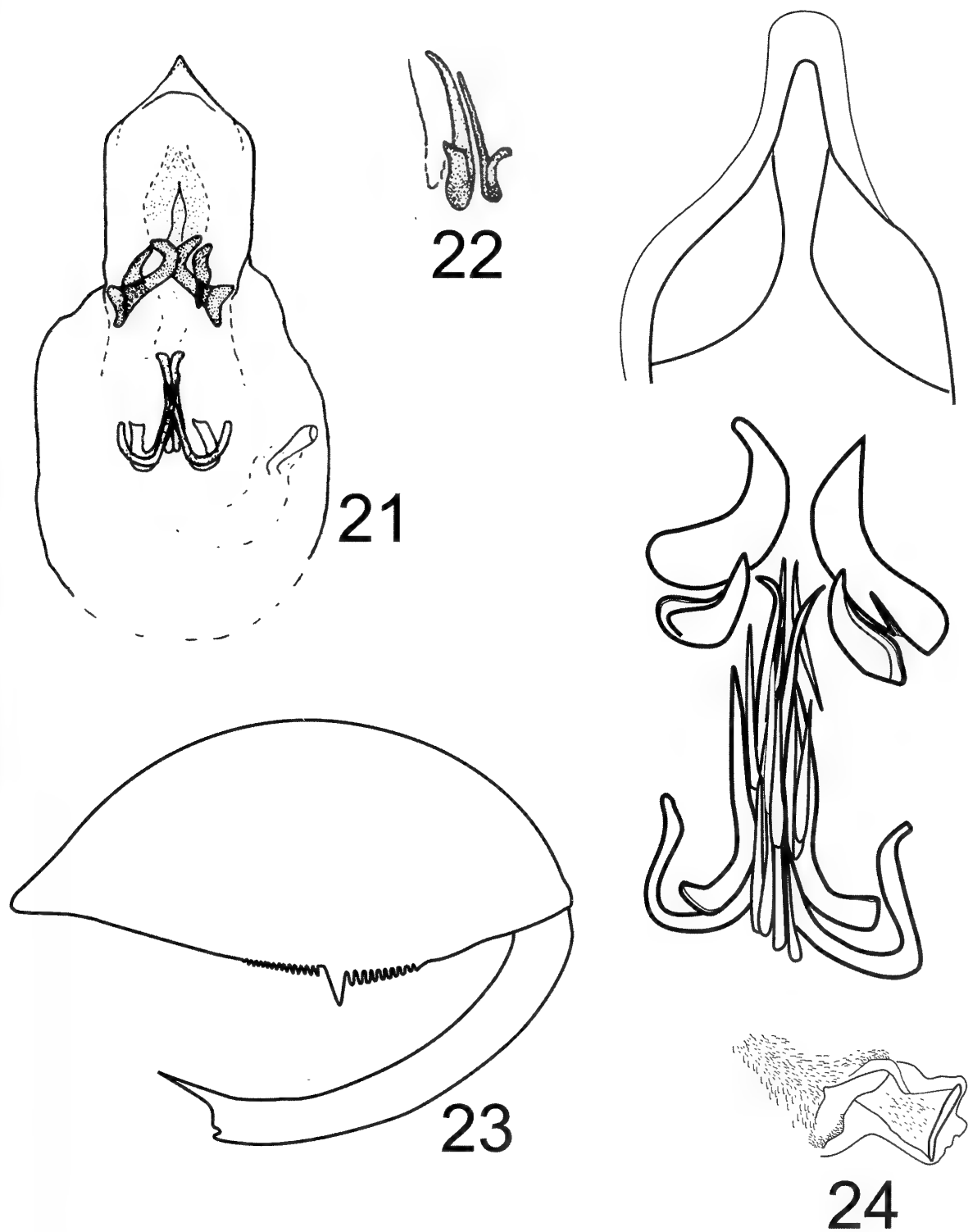
Figs. 9–11. 9, *Caryedon* sp., prothoracic leg; 10, *Caryedon* sp., mesothoracic leg; 11, *Exoctenophorus deflexicollis*, hind femur, lateral view; arrow: spine 1 of pecten.



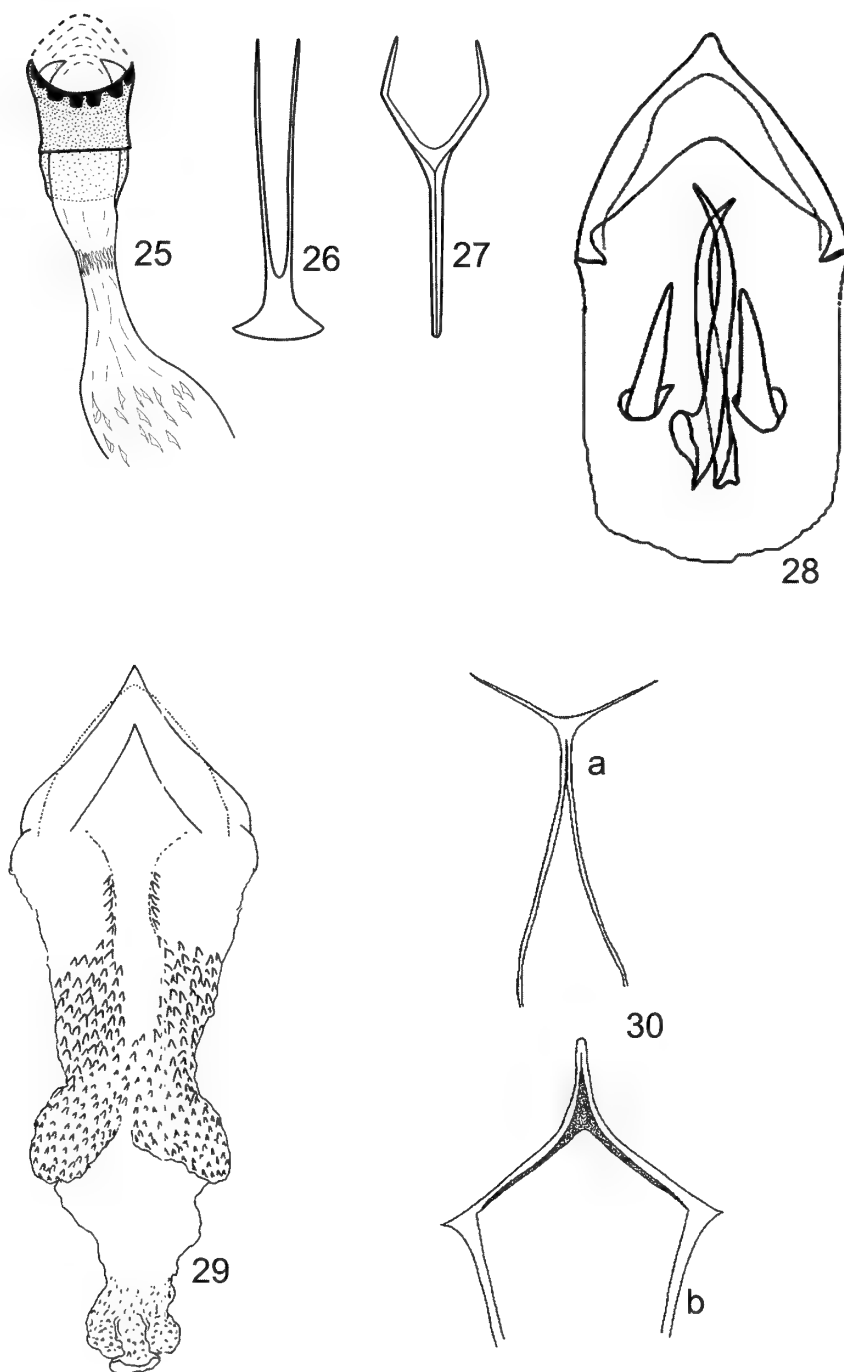
Figs. 12-13. 12, Wings of Pachymerinae. a, *Caryedon*; b, *Pachymerus*; 13, Wings of Bruchinae; a, *Callosobruchus*; b, *Acanthoscelides*.



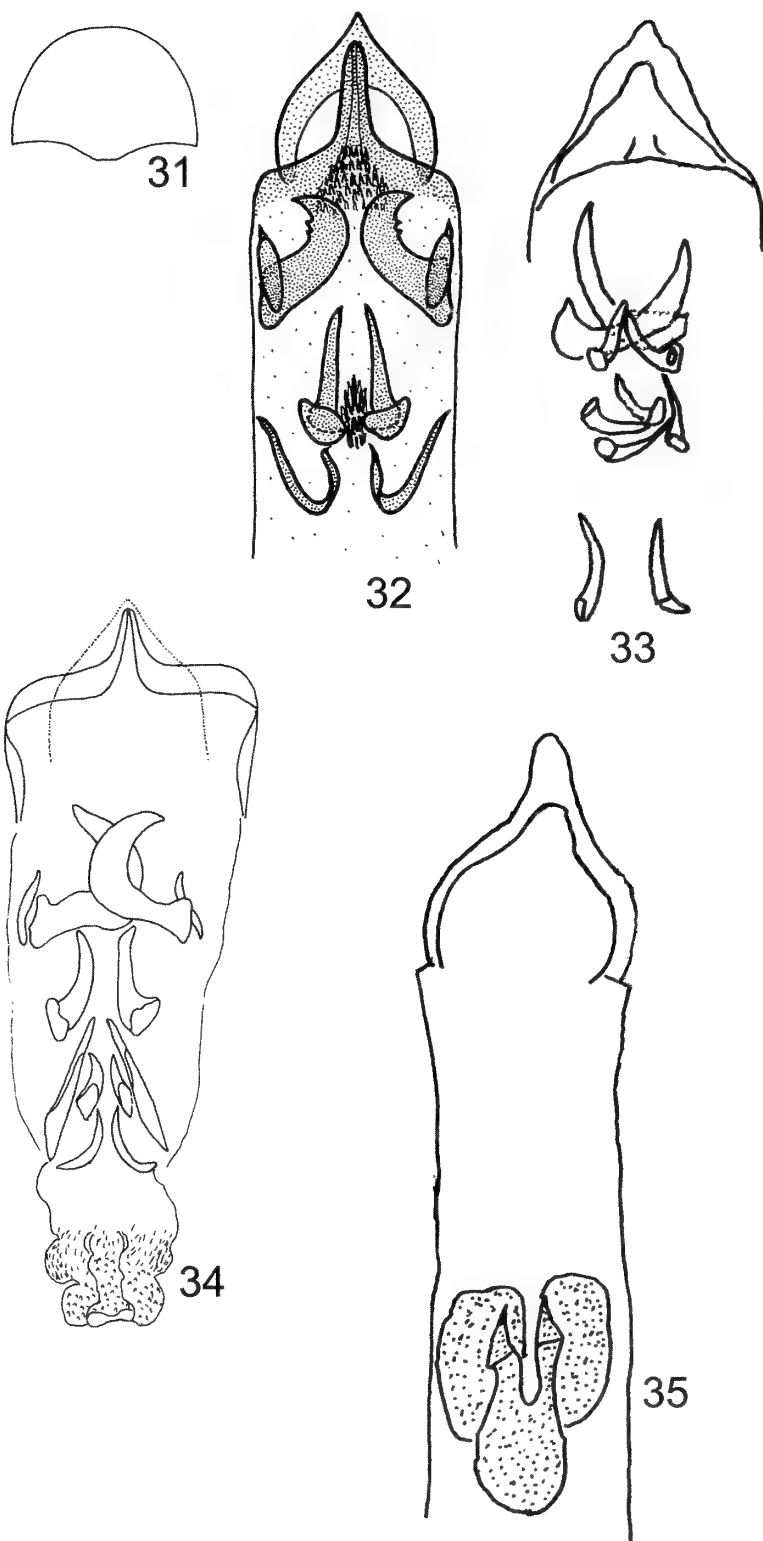
Figs. 14–20. 14, *Caryedon serratus*, lateral view of male genitalia: median lobe and tegmen; bp: basal piece; bs: sclerites; dv: dorsal valve; is: internal sac; ll: lateral lobes; ms: medial sclerites; bh: basal hood; ts: tegminal strut; vv: ventral valve; 15, *Afroredon africanus*, hind leg, medial view; arrow: spine 1 of pecten; mc: mesal carina; 16, *A. africanus*, prosternal process; arrow: prosternal process; 17, *Caryedon serratus*, prosternal process; arrow: prosternal process; 18, *Afroredon africanus*, stria and scutellum; 1: stria 1; 2: stria 2; large arrow: special stria character; small arrow: absence or presence of marginal line on pronotum; 19, *Caryedon serratus*, stria and scutellum; arrow: incomplete carina on pronotum; 1: stria 1; 2: stria 2; 20, *C. serratus*, pronotal carina; lat: lateral prothoracic carina; mep: mesoepimeral plate; mar: marginal line.



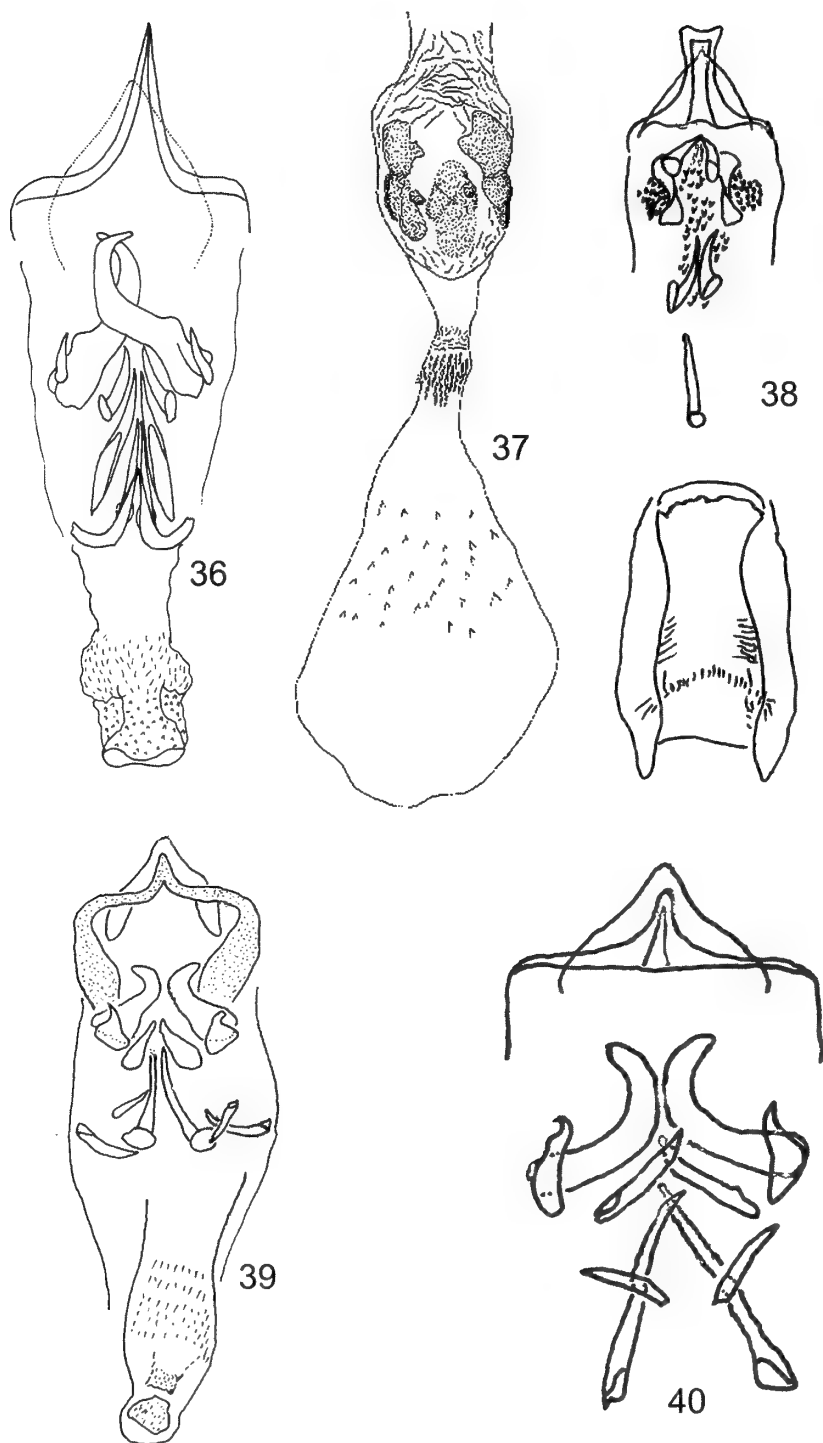
Figs. 21-24. 21, *Caryedon* sp., male genitalia, median lobe; 22, *Caryedon* sp., male genitalia, structure of basal sclerite; 23, *Caryedon Denticulatus* Group, hind leg; 24, *C. acaciae*, male genitalia.



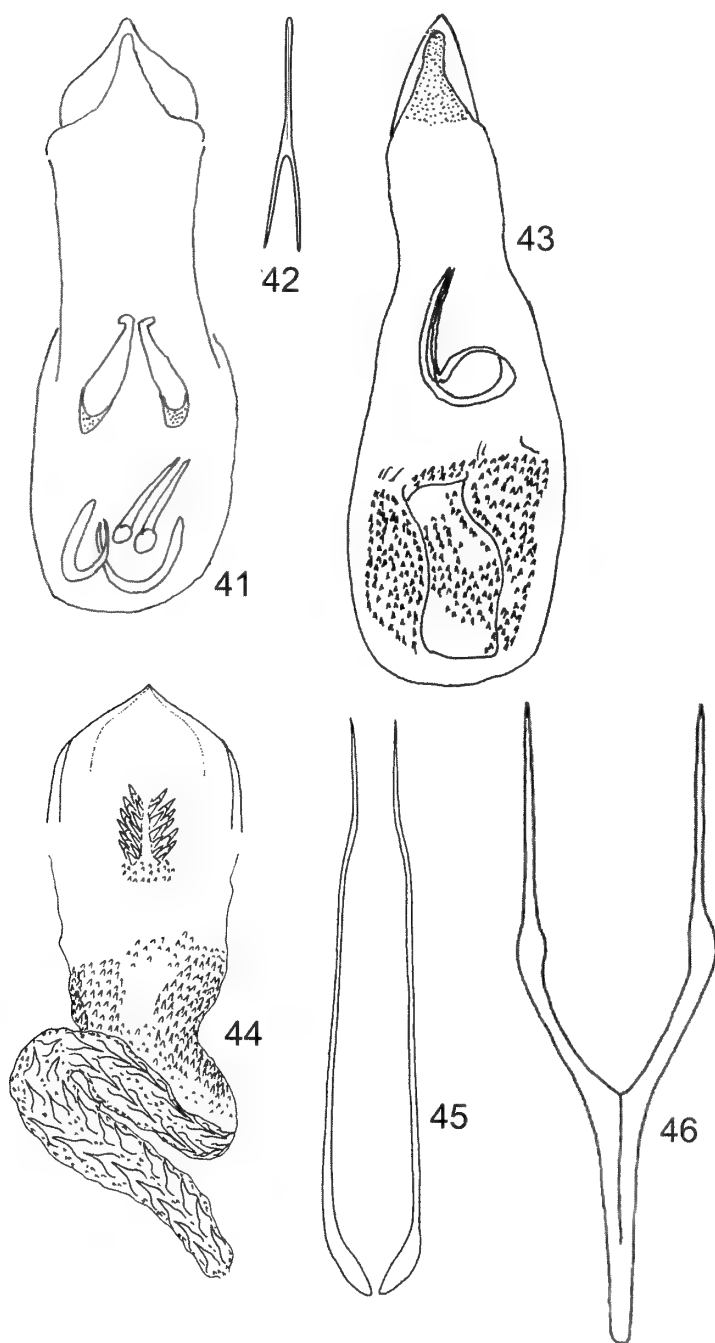
Figs. 25–30. 25, *Caryedon acaciae*, female genitalia, bursa copulatrix and vaginal plates; 26, *Caryedon* female genitalia, abdominal tergite 9; 27, *C. acaciae*, female genitalia, spiculum ventrale; 28, *C. albonotatus*, male genitalia; 29, *C. alluaudi*, male genitalia; 30, *C. amplipennis*, female genitalia: a. ovipositor lobes; b. spiculum ventrale.



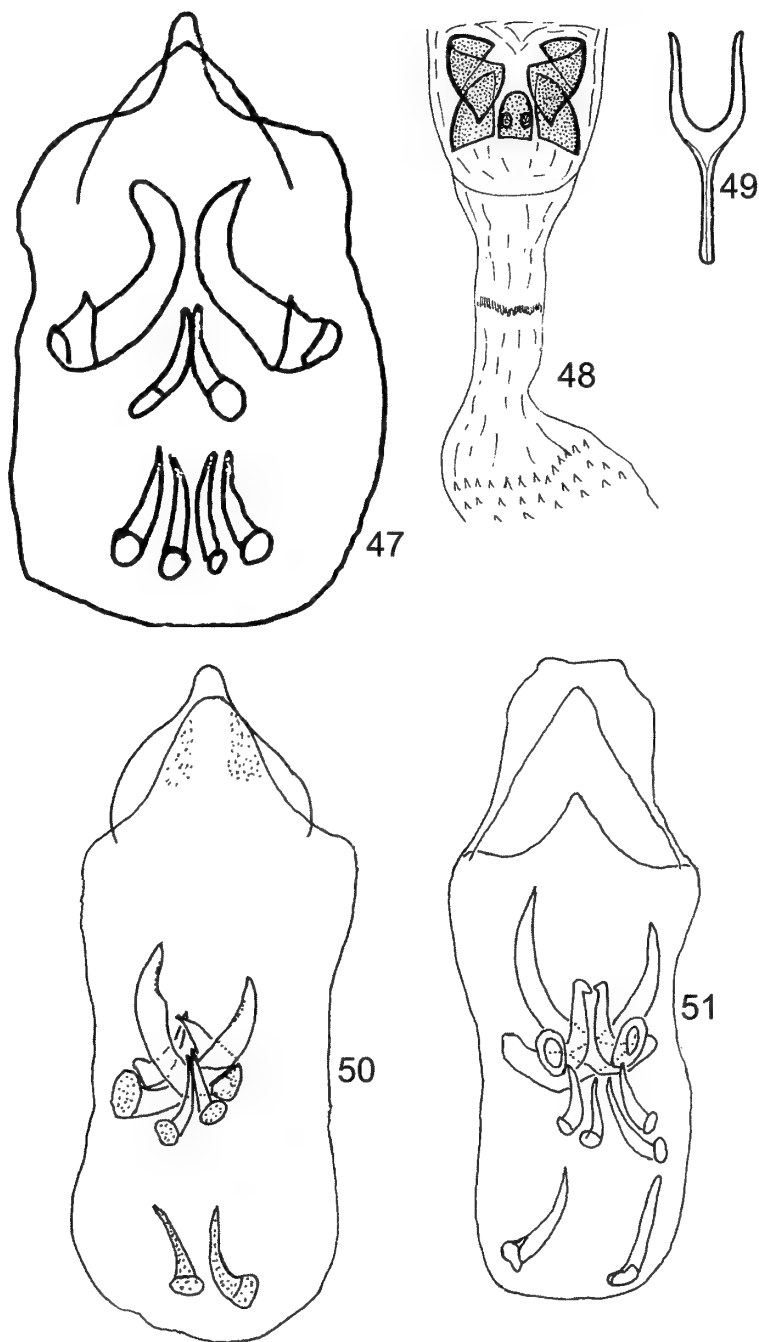
Figs. 31–35. 31, *Caryedon arenarum*, pronotum; 32, *C. arenarum*, male genitalia; 33, *C. atrohumeralis*, male genitalia; 34, *C. beniowskii*, male genitalia; 35, *C. calderoni*, male genitalia.



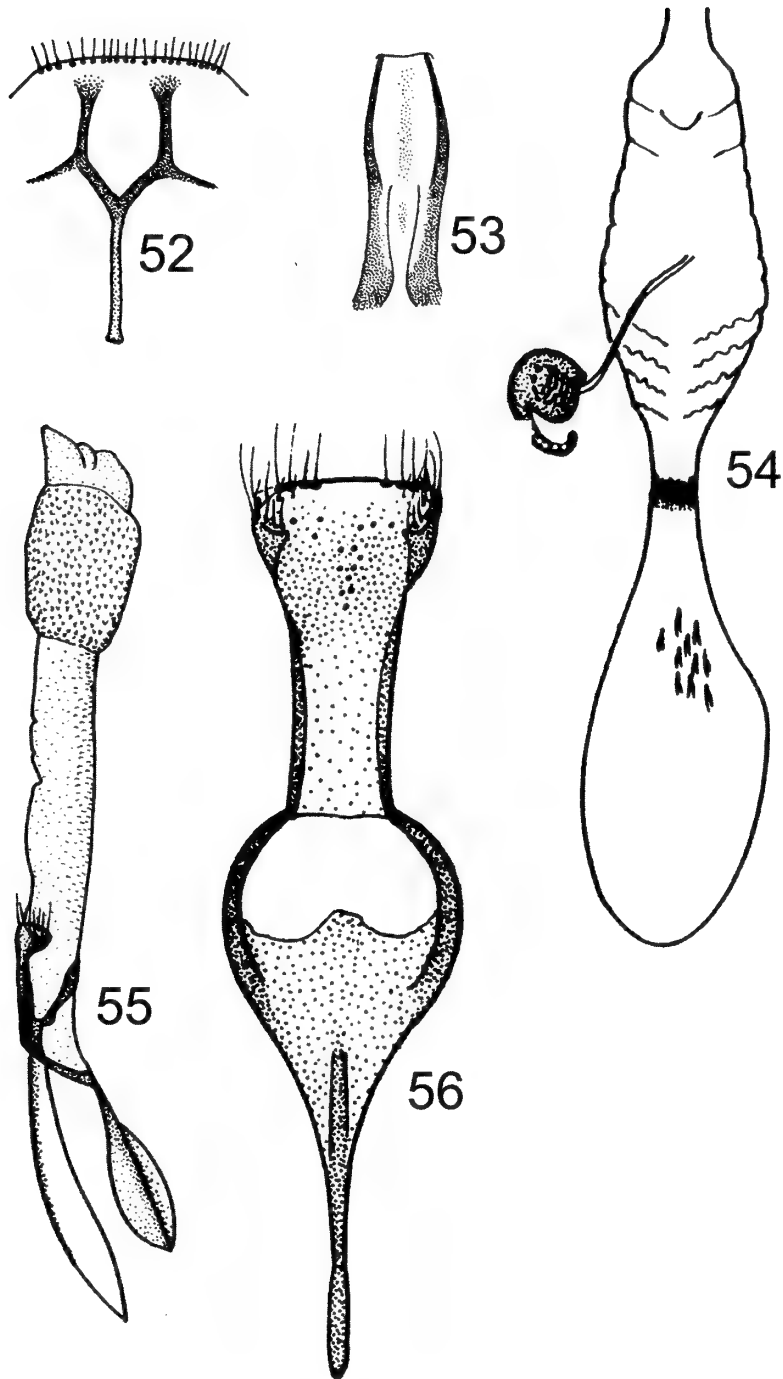
Figs. 36–40. 36, *Caryedon cassiae*, male genitalia; 37, *C. cassiae*, female genitalia: bursa copulatrix and vaginal sclerites; 38, *C. conformis*, male genitalia; 39, *C. congensis*, male genitalia, median lobe; 40, *C. crampeli*, male genitalia, median lobe.



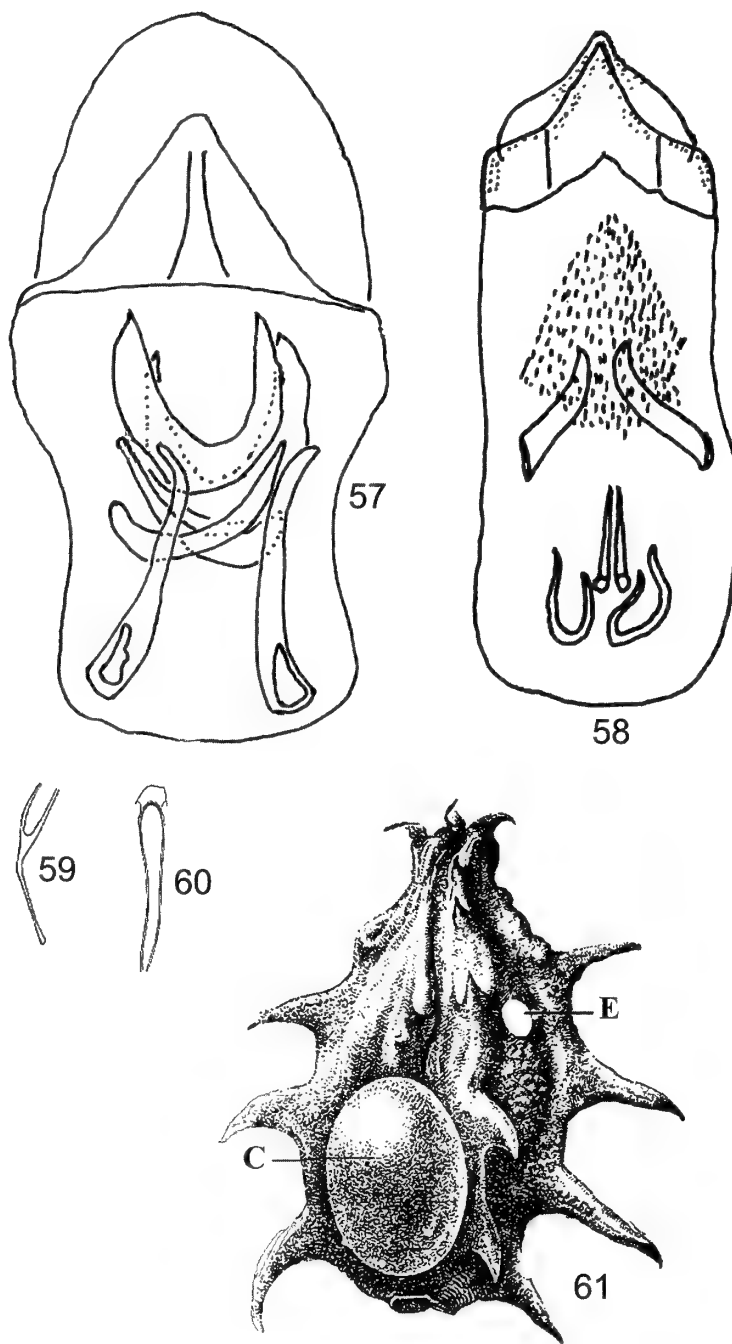
Figs. 41–46. 41, *Caryedon cyprus*, male genitalia; 42, *C. cyprus*, female genitalia, spiculum ventrale; 43, *C. decellei*, male genitalia; 44, *C. denticulatus*, male genitalia; 45, *C. denticulatus*, female genitalia, sclerites of ovipositor; 46, *C. denticulatus*, female genitalia, spiculum ventrale.



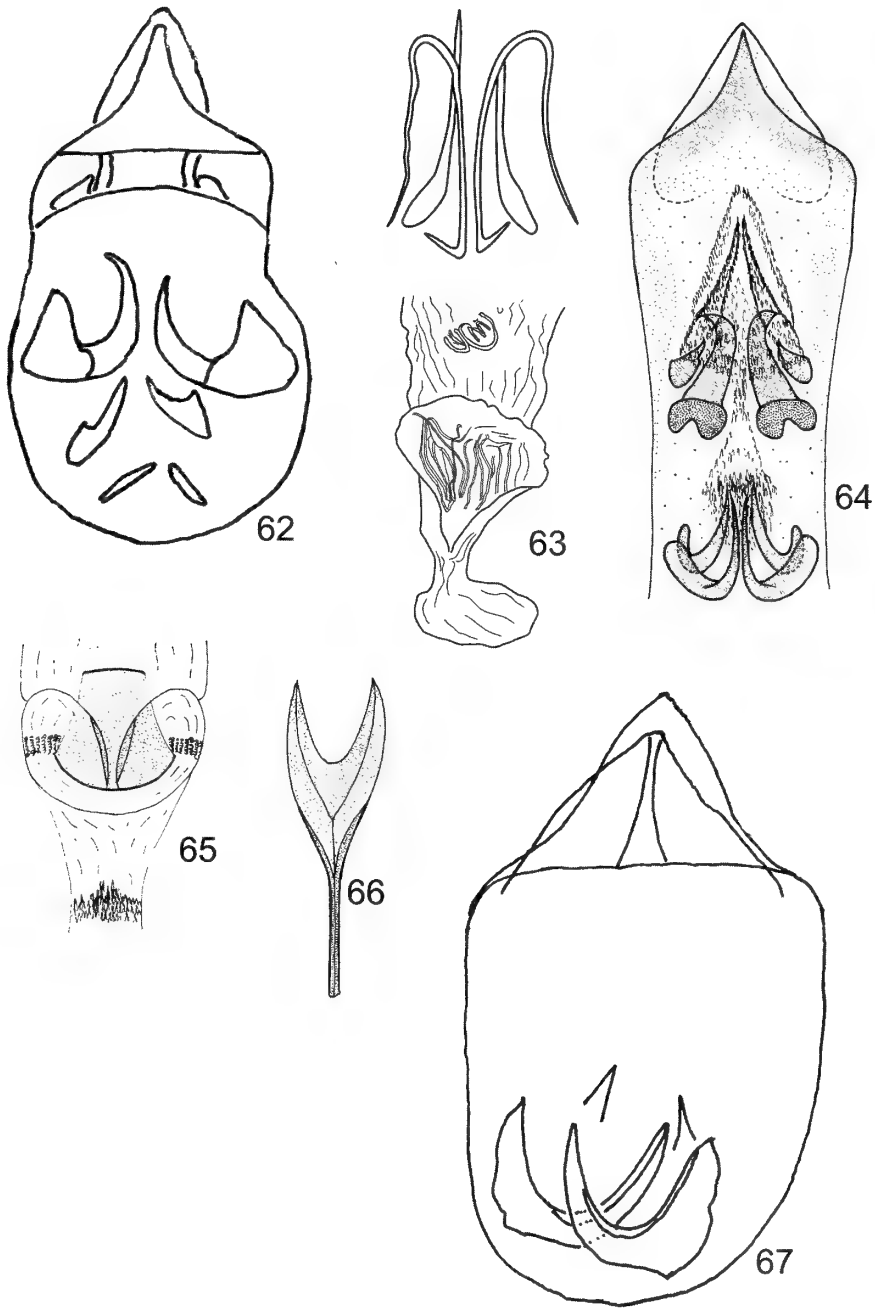
Figs. 47–51. 47, *Caryedon dialii*, male genitalia; 48, *C. dialii*, female genitalia, vaginal plates and bursa copulatrix; 49, *C. dialii*, female genitalia, spiculum ventrale; 50, *C. elongatus*, male genitalia, median lobe; 51, *C. fasciatus*, male genitalia, median lobe.



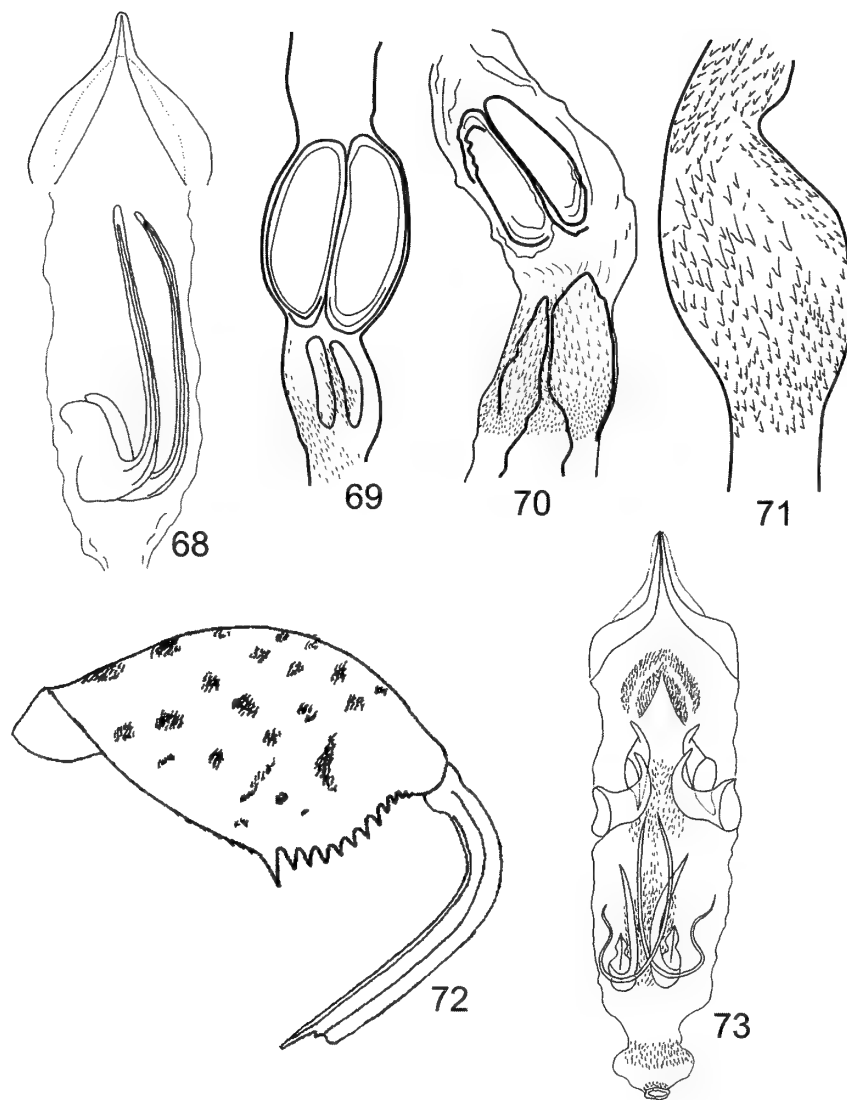
Figs. 52-56. 52, *Caryedon fathalae*, female genitalia, sternite VIII; 53, *C. fathalae*, female genitalia, tergite IX; 54, *C. fathalae*, female genitalia, dorsal view; 55, *C. fathalae*, male genitalia, lateral view of tegmen with internal sac inflated; 56, *C. fathalae*, male genitalia, ventral view, lateral lobes and tegminal strut.



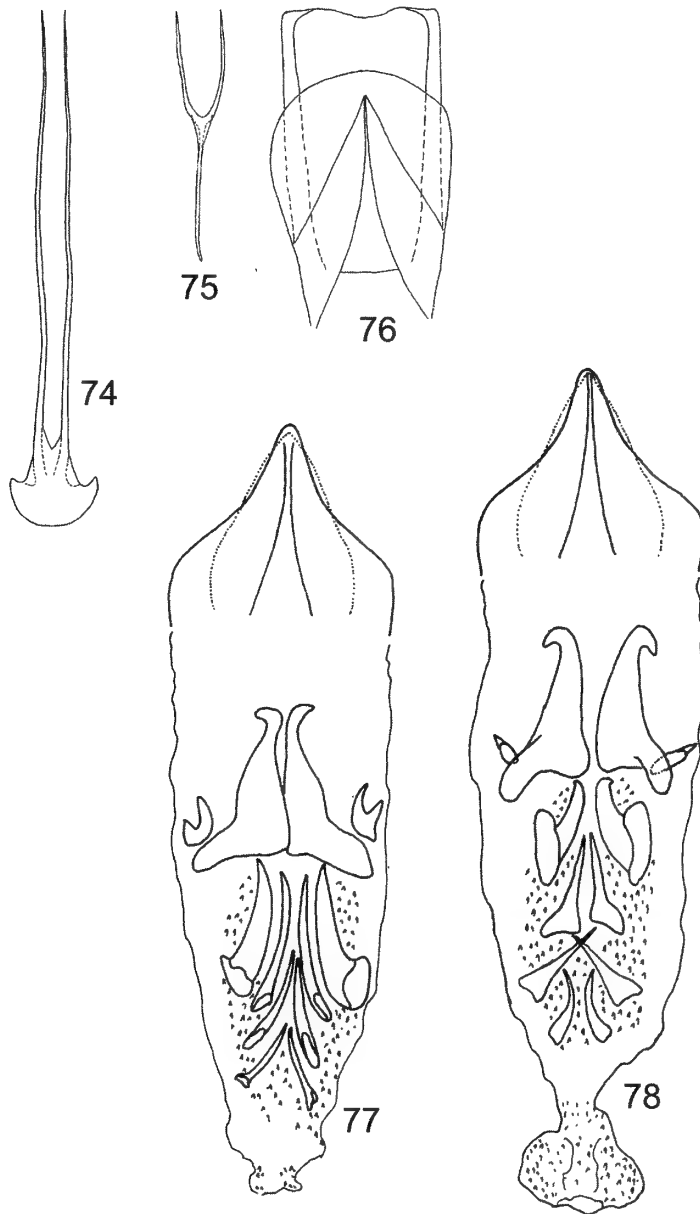
Figs. 57–61. 57, *Caryedon fuliginosus*, male genitalia, median lobe; 58, *C. germari*, male genitalia, median lobe; 59, *C. germari*, female genitalia, spiculum ventrale; 60, *C. germari*, female genitalia, sclerite of ovipositor; 61, Fruit of *Lisaea heterocarpa*, with cocoon (C) and egg (E) of *C. germari*.



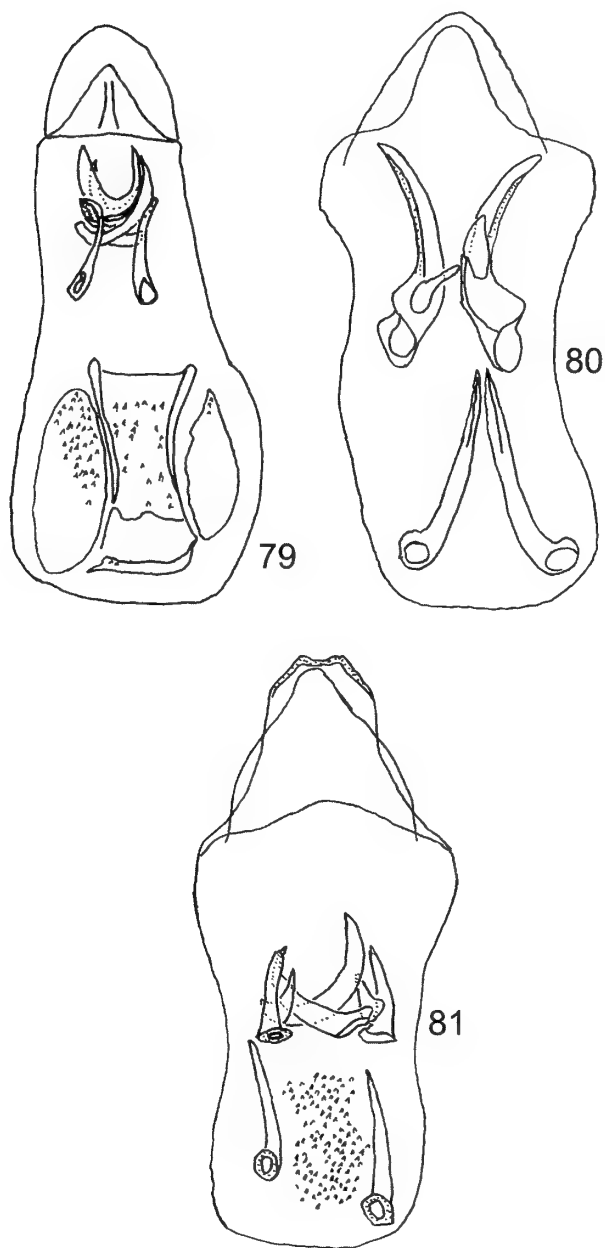
Figs. 62–67. 62, *Caryedon gigas*, male genitalia, median lobe; 63, *C. gigas*, female genitalia, ovipositor lobes and spiculum ventrale; 64, *C. grandis*, male genitalia, median lobe; 65, *C. grandis*, female genitalia, vaginal plates; 66, *C. grandis*, female genitalia, spiculum ventrale; 67, *C. immaculatus*, male genitalia, median lobe.



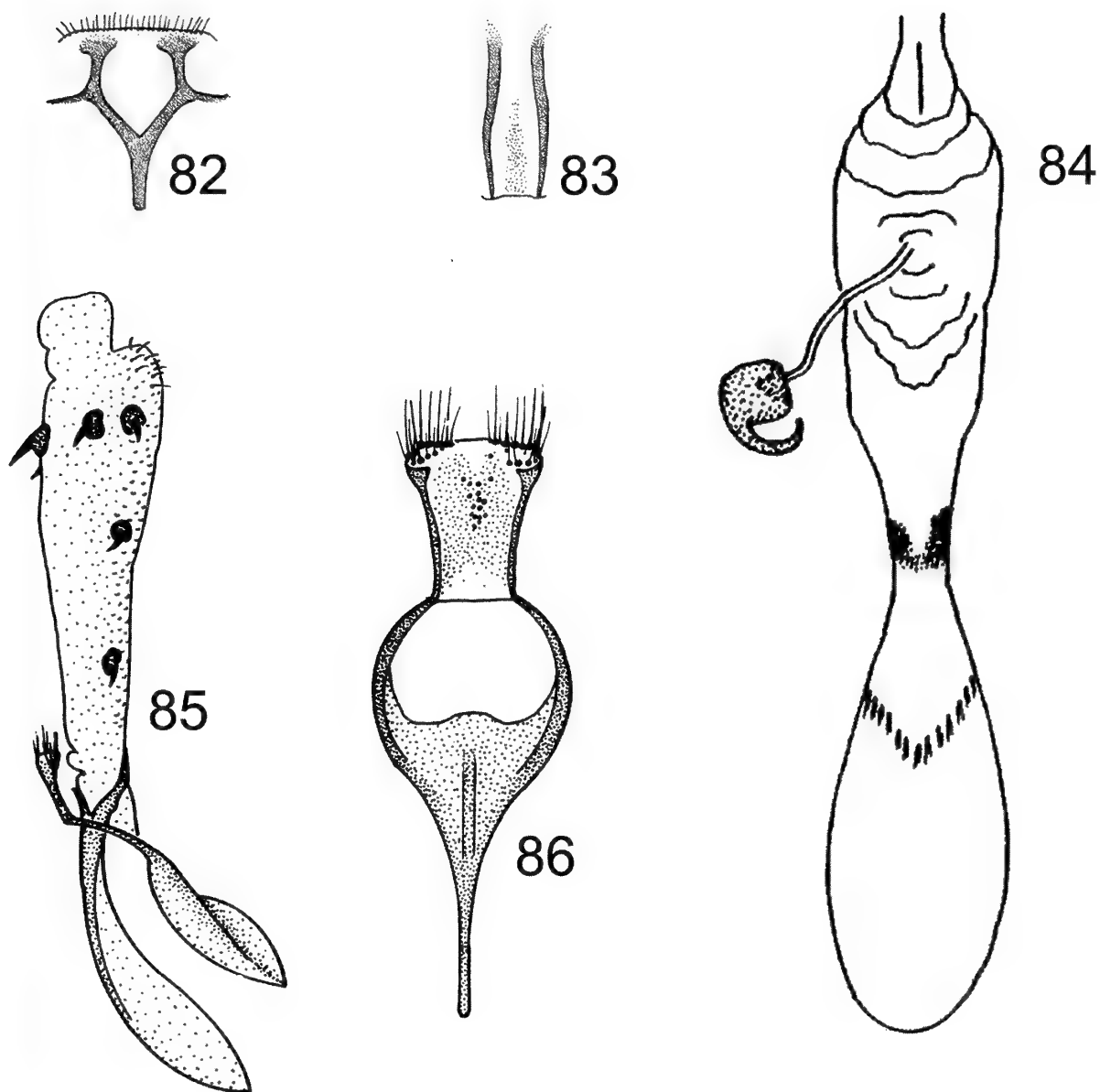
Figs. 68–73. 68, *Caryedon interstinctus*, male genitalia, median lobe; 69, *C. interstinctus* complex, female genitalia variation; 70, *C. interstinctus* complex, female genitalia variation; 71, *C. interstinctus* complex, female genitalia variation; 72, *C. johni*, hind leg, lateral view; 73, *C. johni*, male genitalia, median lobe.



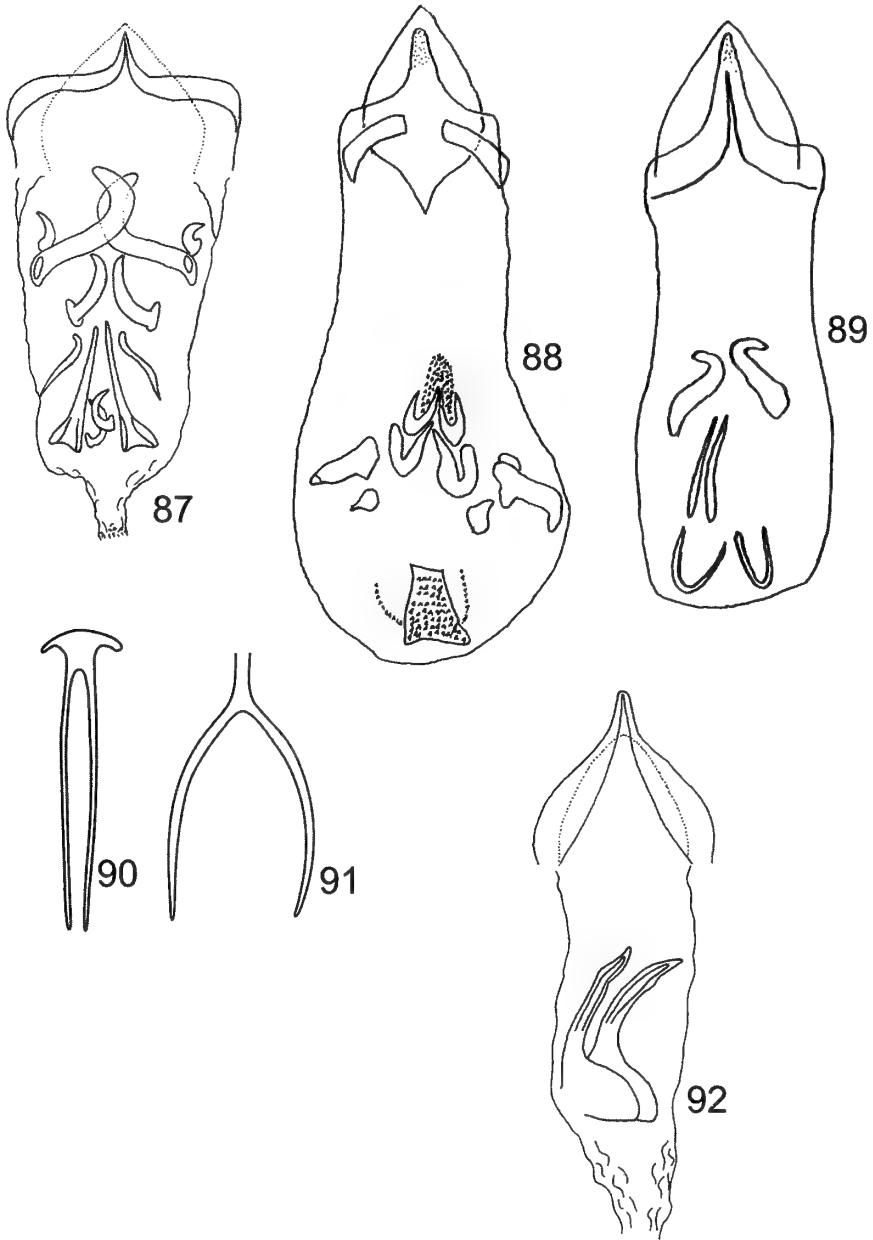
Figs. 74–78. 74, *Caryedon johni*, female genitalia, sclerite of ovipositor; 75, *C. johni*, female genitalia, spiculum ventrale; 76, *C. johni*, female genitalia, vaginal sclerites; 77, *C. kivuensis*, male genitalia, median lobe, from Zambia; 78, *C. kivuensis*, male genitalia, median lobe, from Ghana.



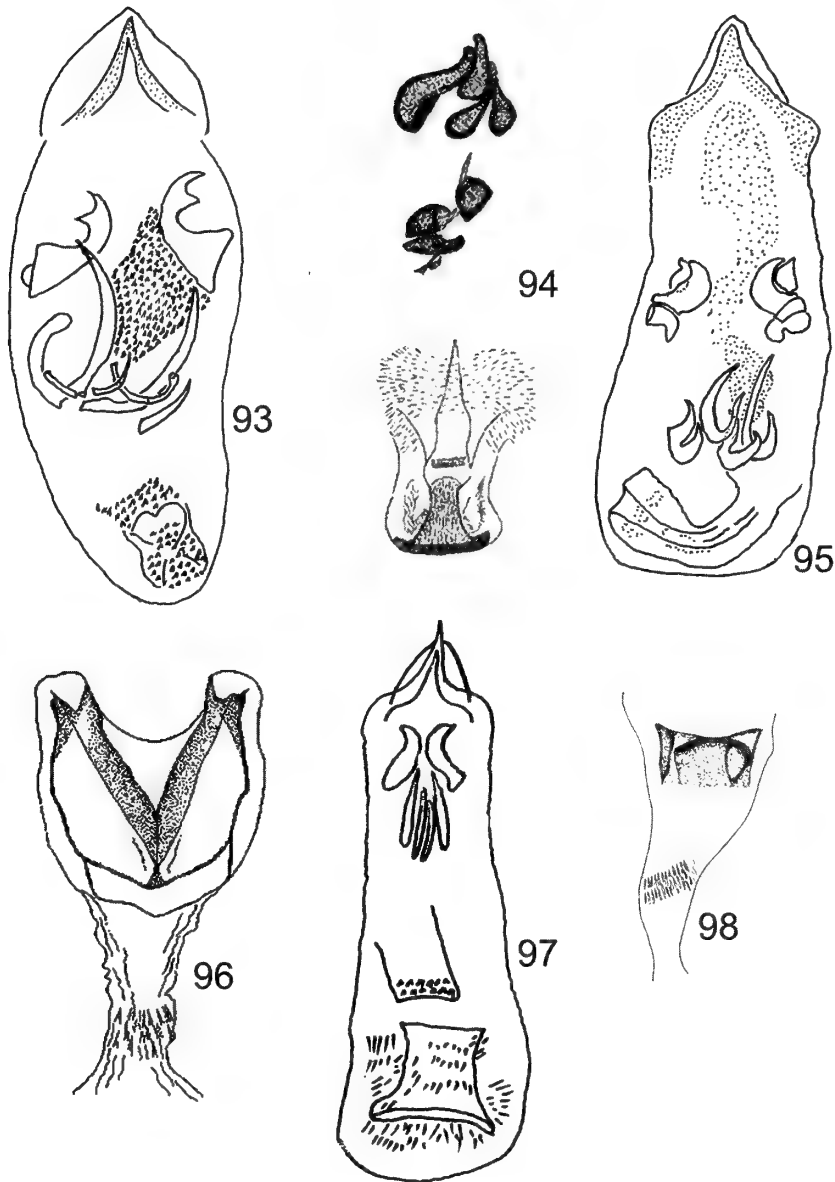
Figs. 79–81. 79, *Caryedon longipennis*, male genitalia, median lobe; 80, *C. longus*, male genitalia, median lobe; 81, *C. lunatus*, male genitalia, median lobe.



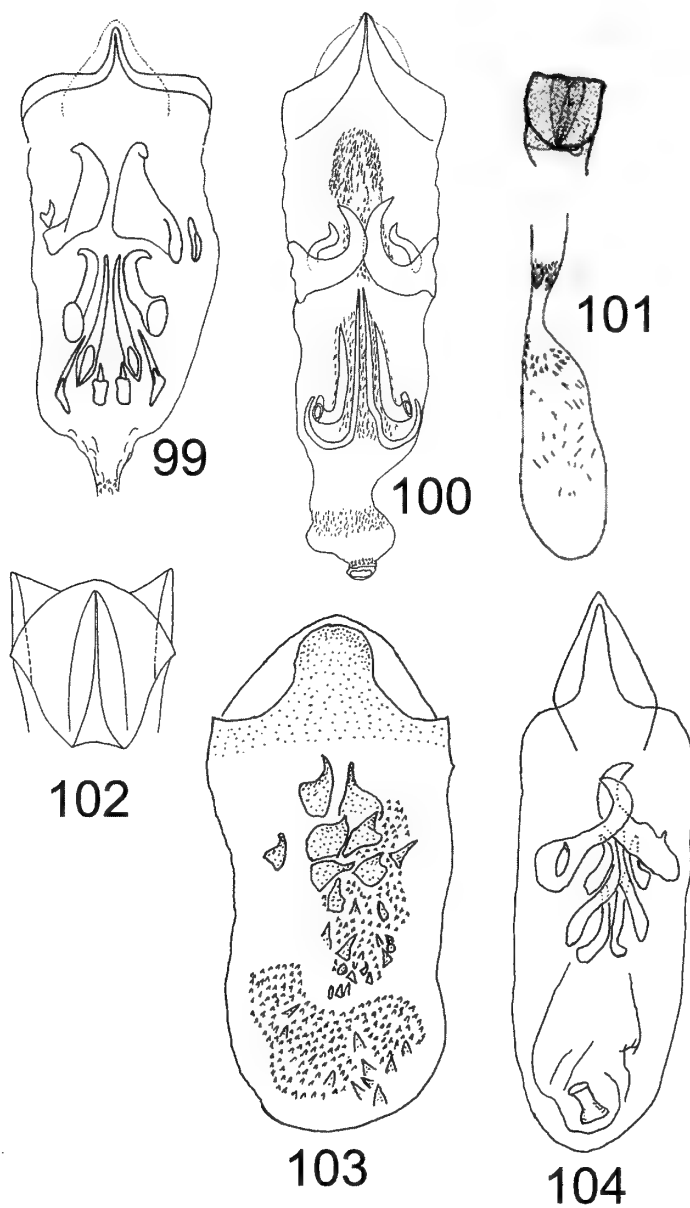
Figs. 82–86. 82, *Caryedon macropterae* female genitalia, sternite VIII; 83, *C. macropterae*, female genitalia, tergite IX; 84, *C. macropterae*, female genitalia, dorsal view; 85, *C. macropterae*, male genitalia, lateral view of tegmen with internal sac inflated; 86, *C. macropterae*, male genitalia, ventral view, lateral lobes and tegminal strut.



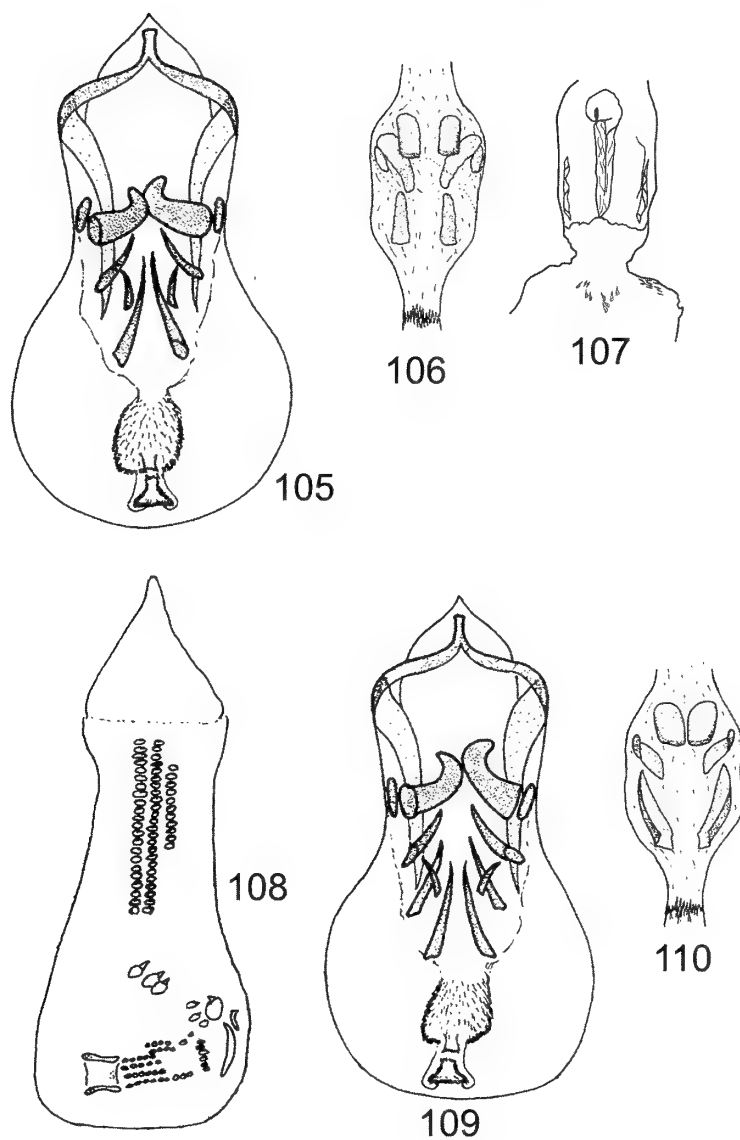
Figs. 87–92. 87, *Caryedon maculipes*, male genitalia, median lobe; 88, *C. meinanderi*, male genitalia, median lobe; 89, *C. mesra*, male genitalia, median lobe; 90, *C. mesra* female genitalia, ovipositor lobes; 91, *C. mesra*, female genitalia, spiculum ventrale; 92, *C. multinotatus*, male genitalia, median lobe.



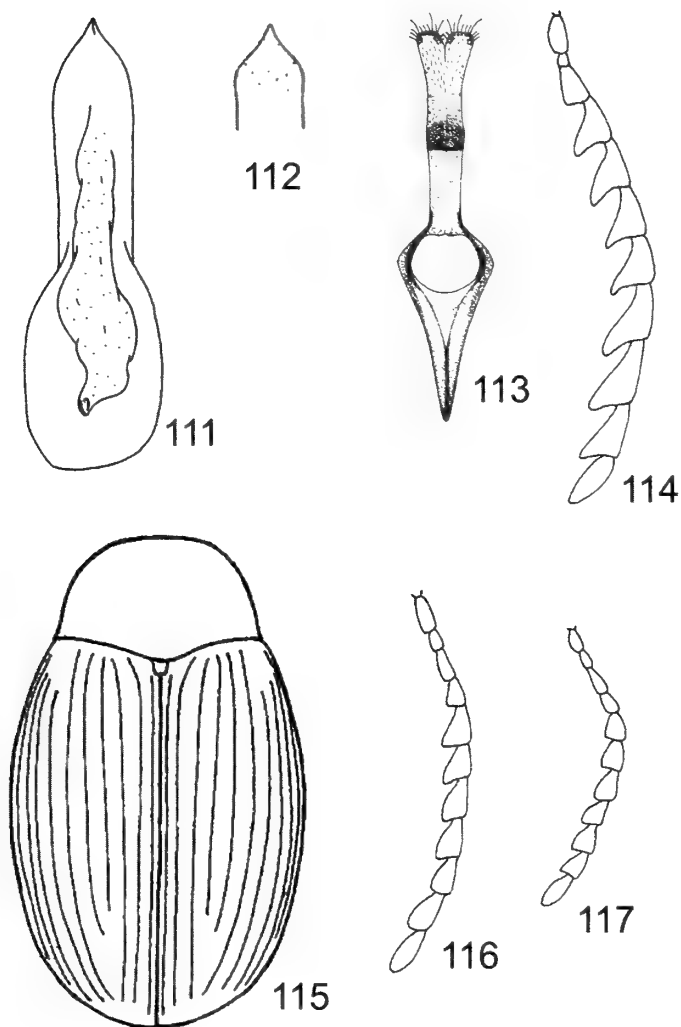
Figs. 93–98. 93, *Caryedon nigrinus*, male genitalia, median lobe; 94, *C. nigrosignatus*, male genitalia, median lobe; 95, *C. palaestinus*, male genitalia, median lobe; 96, *C. palaestinus*, female genitalia, vaginal sclerites and bursa copulatrix; 97, *C. pallidus*, male genitalia, median lobe; 98, *C. pallidus*, female genitalia, vaginal sclerites and bursa copulatrix.



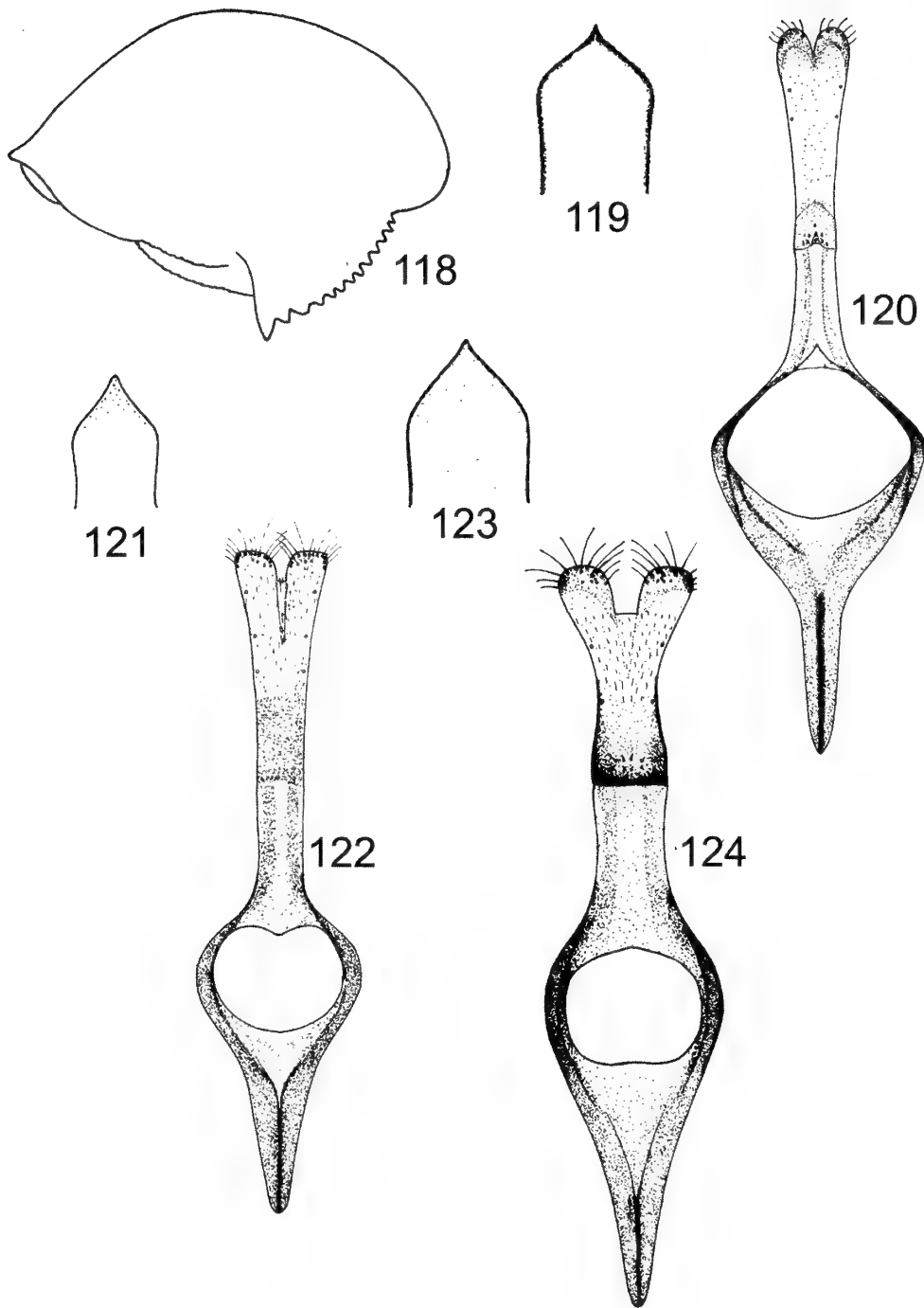
Figs. 99–104. 99, *Caryedon proshynskii*, male genitalia, median lobe; 100, *C. serratus*, male genitalia, median lobe; 101, *C. serratus*, female genitalia, vaginal plates, bursa copulatrix, spiculum ventrale; 102, *C. serratus*, female genitalia, vaginal sclerites; 103, *C. skaifei*, male genitalia, median lobe; 104, *C. sparsus*, male genitalia, median lobe.



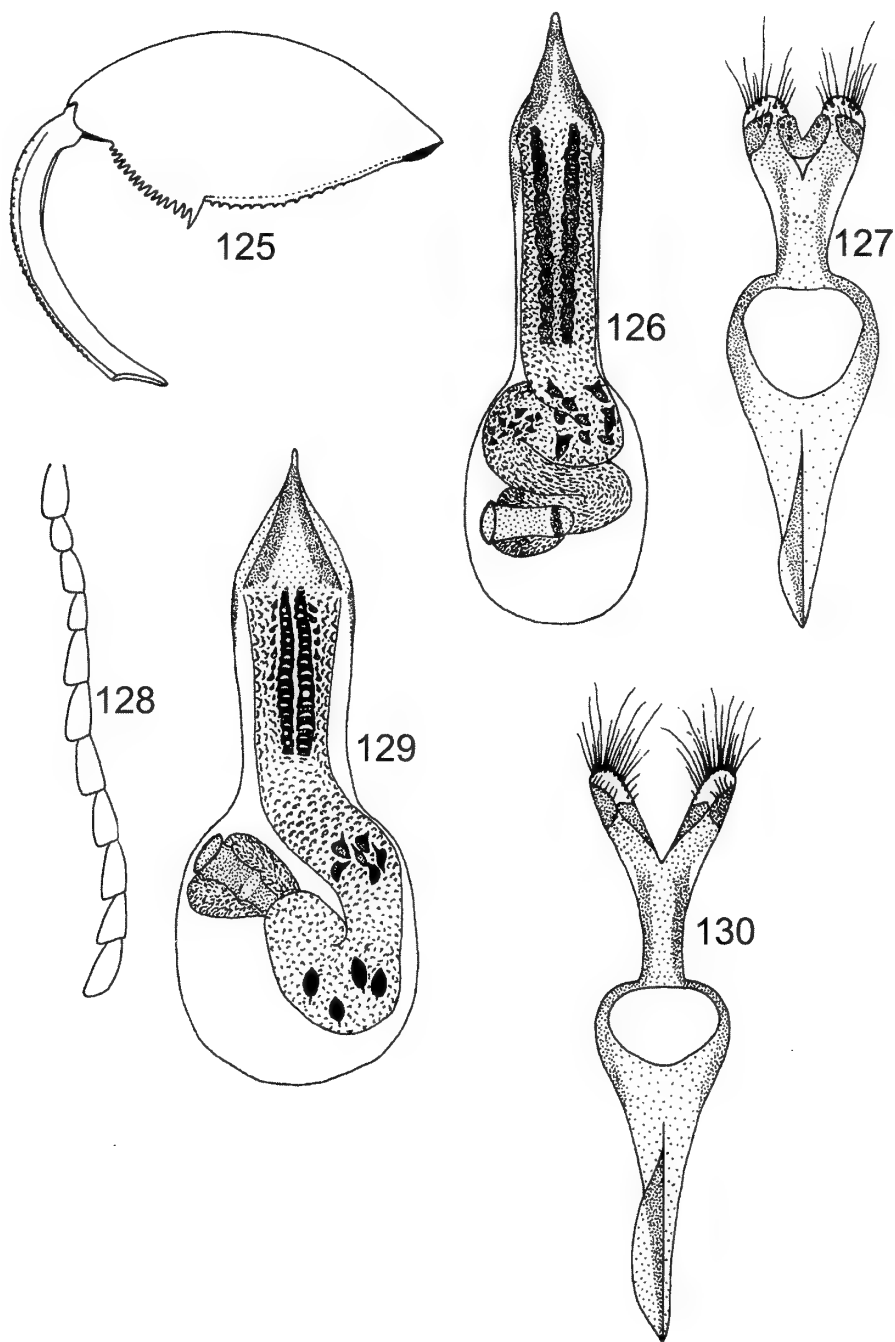
Figs. 105–110. 105, *Caryedon sudanensis*, male genitalia, median lobe; 106, *C. sudanensis*, female genitalia, vaginal sclerites; 107, *C. uganda*, female genitalia, vaginal sclerites; 108, *C. vinsoni*, male genitalia, median lobe; 109, *C. yemenensis*, male genitalia, median lobe; 110, *C. yemenensis*, female genitalia, vaginal sclerites.



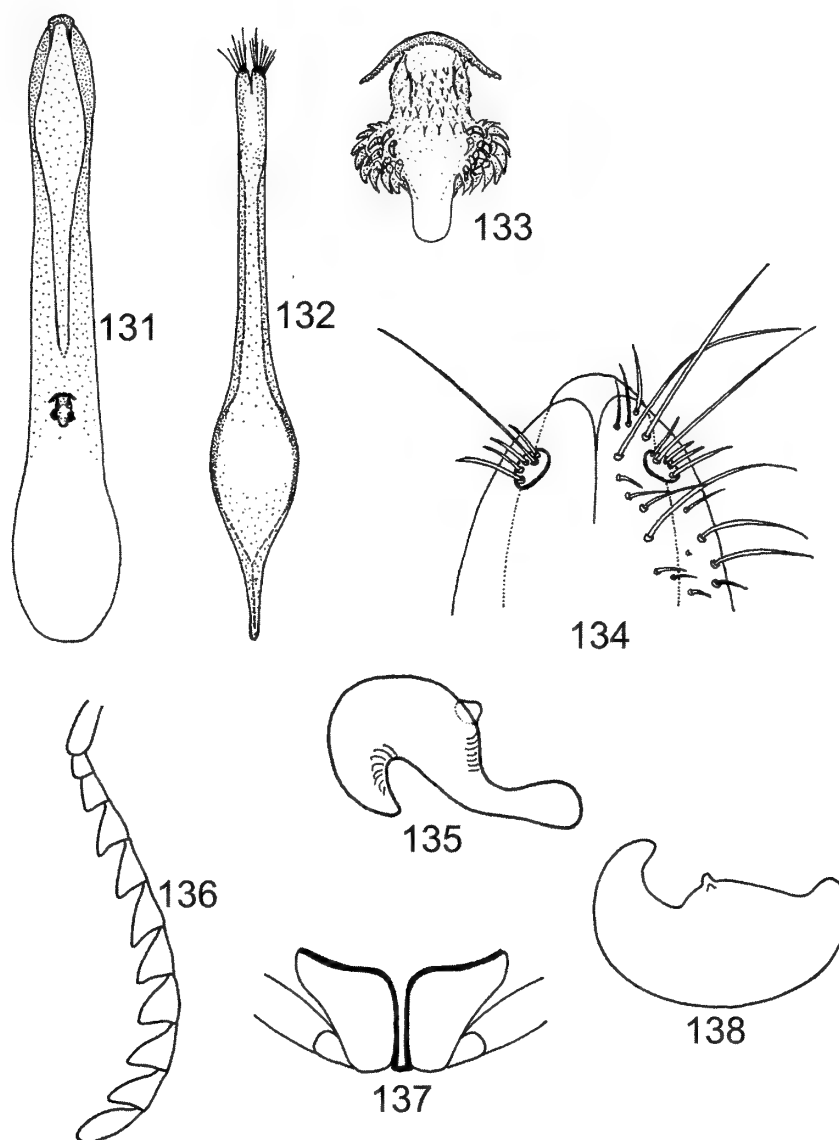
Figs. 111–117. 111, *Afroredon*, male genitalia, median lobe; 112, *A. africanus*, male genitalia, apex median lobe; 113, *A. africanus*, male genitalia, lateral lobes, tegminal strut; 114, *A. ritchiei*, antenna; 115, *A. ritchiei*, dorsal aspect; 116, *A. katanganus*, antenna; 117, *A. africanus*, antenna.



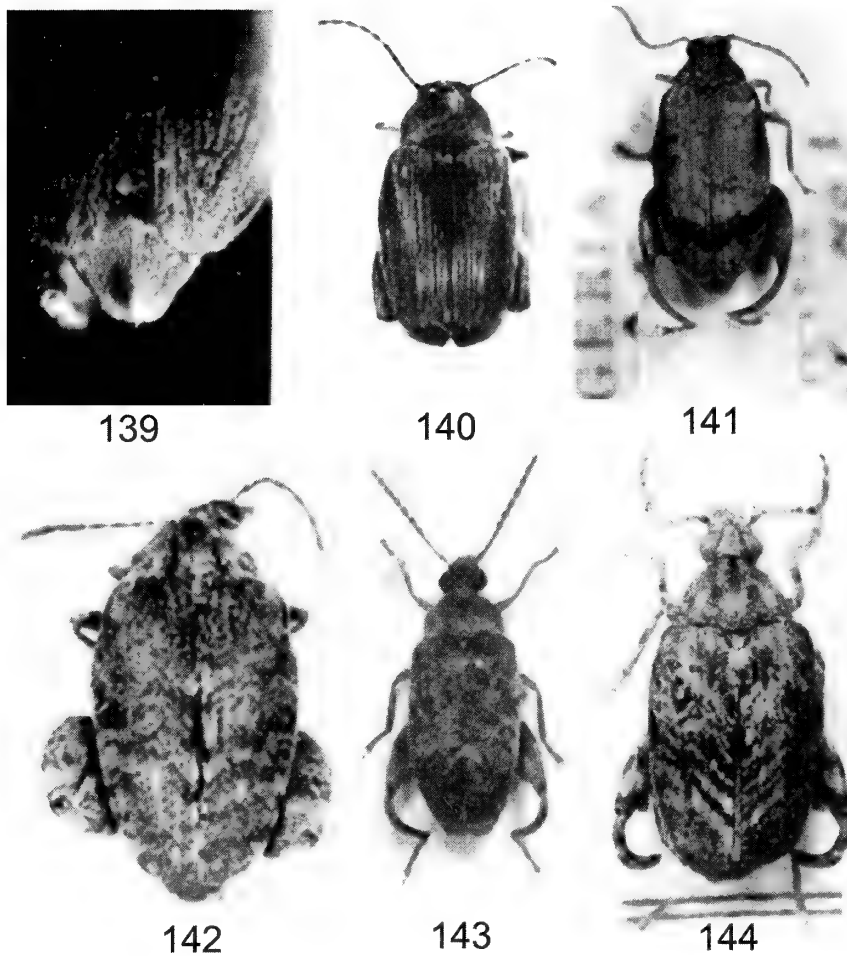
Figs. 118–124. 118, *Afroredon katanganus*, hind femur, medial view; 119, *A. katanganus*, male genitalia, apex median lobe; 120, *A. katanganus*, male genitalia, lateral lobes, tegminal strut; 121, *A. martini*, male genitalia, apex median lobe; 122, *A. martini*, male genitalia, lateral lobes, tegminal strut; 123, *A. ritchiei*, male genitalia, apex median lobe; 124, *A. ritchiei*, male genitalia, lateral lobes, tegminal strut.



Figs. 125–130. 125, *Caryotrypes minor*, hind femur, medial view; 126, *C. minor*, male genitalia, median lobe; 127, *C. minor*, male genitalia, lateral lobes, tegminal strut; 128, *C. pandani*, antenna; 129, *C. pandani*, male genitalia, median lobe; 130, *Caryotrypes pandani*, male genitalia, lateral lobes, tegminal strut.



Figs. 131–138. 131, *Exoctenophorus deflexicollis*, male genitalia, median lobe; 132, *E. deflexicollis*, male genitalia, lateral lobes, tegminal strut; 133, *E. deflexicollis*, male genitalia, sclerite of internal sac; 134, *E. deflexicollis*, female genitalia, apex of ovipositor; 135, *E. deflexicollis*, female genitalia, spermatheca; 136, *Mimocaryedon freyi*, antenna; 137, *M. freyi*, prosternal process; 138, *M. freyi*, female genitalia, spermatheca.



Figs. 139–144. 139, *Caryedon sudanensis*, female pygidium; 140, *C. cassiae*, dorsal aspect; 141, *C. lunatus*, dorsal aspect; 142, *C. amplipennis*, dorsal aspect; 143, *C. serratus*, dorsal aspect; 144, *C. multinotatus*, dorsal aspect.



145



146



147



148

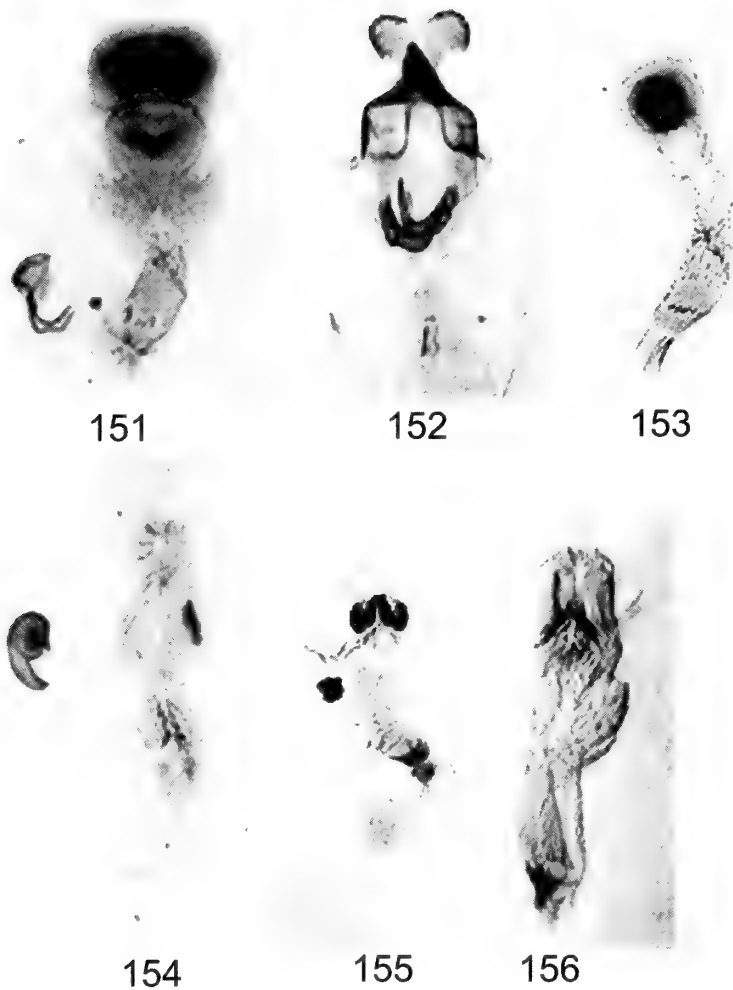


149

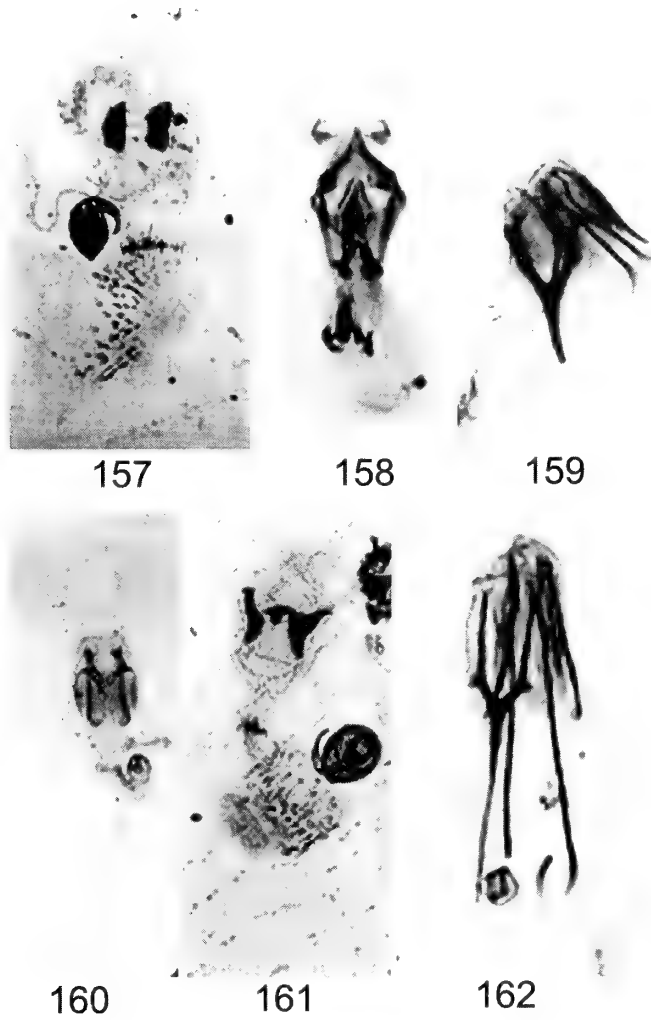


150

Figs. 145–150. 145, *Caryedon alluaudi*, dorsal aspect; 146, *C. vinsoni* male genitalia; 147, *C. albonotatus*, male genitalia; 148, *C. amplipennis*, female genitalia; 149, *C. atrohumeralis*, female genitalia; 150, *C. fasciatus*, female genitalia.



Figs. 151–156. 151, *Caryedon fuliginosus*, female genitalia; 152, *C. immaculatus*, male genitalia; 153, *C. immaculatus*, female genitalia; 154, *C. interstinctus*, female genitalia; 155, *C. longipennis*, female genitalia; 156, *C. lunatus*, female genitalia.



Figs. 157–162. Fig. 157, *Caryedon maculipes*, female genitalia; 158, *C. maculatus*, male genitalia; 159, *C. multinotatus*, female genitalia; 160, *C. nigrinus*, female genitalia; 161, *C. sparsus*, female genitalia; 162, *C. alluaudi*, female genitalia.

INDEX

Only taxonomic names of Bruchidae are included in the index. All available genus and species names are followed by their author. All valid names are given in **bold italics**, synonyms in *italics*, and unavailable names in plain type face. Only the page numbers for the main taxonomic entries are given.

acaciae (Gyllenhal), 20
accaciae, 20
africanus Decelle, 75
Afroredon Decelle, 73
akdamaricus Decelle & Lodos, 24
albonotatus (Pic), 24
allaudi, 25
alluaudi (Allard), 25
amplipennis (Fairmaire), 26
annulicornis (Pic), 63
arenarum Decelle, 27
atricolor (Pic), 59
atrohumeralis Preveit, 28

beniowskii Borowiec, 29
brevelineatus (Pic), 29

calderoni Johnson, Southgate & Delobel, 30
capicola (Motschulsky), 20
cassiae (Gyllenhal), 30
Caryedini, 16
Caryedon Schoenherr, 19
Caryedontini, 16
Caryotrypes Decelle, 77
combreti Preveit, 50
conformis (Fähræus), 32
congoensis Decelle, 33
crampeli Decelle, 34
cyprus Johnson, Southgate & Delobel, 35

decellei Johnson, Southgate & Delobel, 35
deflexicollis Decelle, 80
denticulatus (Klug), 36
dialii Decelle, 38
diversicolor (Pic), 25

Exoctenophorus Decelle, 80
elongatus Johnson, Southgate & Delobel, 39

fasciatus Preveit, 40
fathalae Delobel, 41
freyi Decelle, 81
fuliginosus Preveit, 42
fuscus Bedel *nec* Goeze, 64

germari (Küster), 43
gigas Johnson, Southgate & Delobel, 44

gonager, 64
gonagra (Fabricius), 64
grandis Decelle, 45

immaculatus Preveit, 46
interstinctus (Fähræus), 47
irakensis Al-Ali & Ali, 64

johani Borowiec, 48

katanganus Decelle, 75
kivuensis Decelle, 49

lisaee Southgate, 43
liseae, 43
longipennis (Pic), 50
longus (Pic), 52
lunatus Preveit, 52

macropterae Delobel, 53
maculatus Johnson, Southgate & Delobel, 54
maculipes (Pic), 55
martini (Pic), 76
mauritanicus Decelle, 56
meinanderi Johnson, Southgate & Delobel, 56
mesra Johnson, Southgate & Delobel, 57
Mimocaryedon Decelle, 81
minor Anton, 78
minutus (Pic), 30
multinotatus (Pic), 58

nigrinus Johnson, Southgate & Delobel, 58
nigrosignatus (Pic), 59
notativentris (Pic), 64

Pachymerinae, 16
palaesticus, 60
palaestinus Southgate, 60
pallidulus, 61
pallidus (Olivier), 61
pandani (Blanchard), 79
proszynskii Borowiec, 63

ritchiei (Pic), 76

sahelicus Decelle, 64
serratus Decelle, 77
serratus (Olivier), 64
sibutensis (Pic), 64
skaipei Johnson, Southgate & Delobel, 68
sparsus Johnson, Southgate & Delobel, 69
sudanensis Southgate, 70

tamarindi (Dcaux), 64

uganda Johnson, Southgate & Delobel, 71

vinsoni Johnson, Southgate & Delobel, 71

yemenensis Decelle, 72

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